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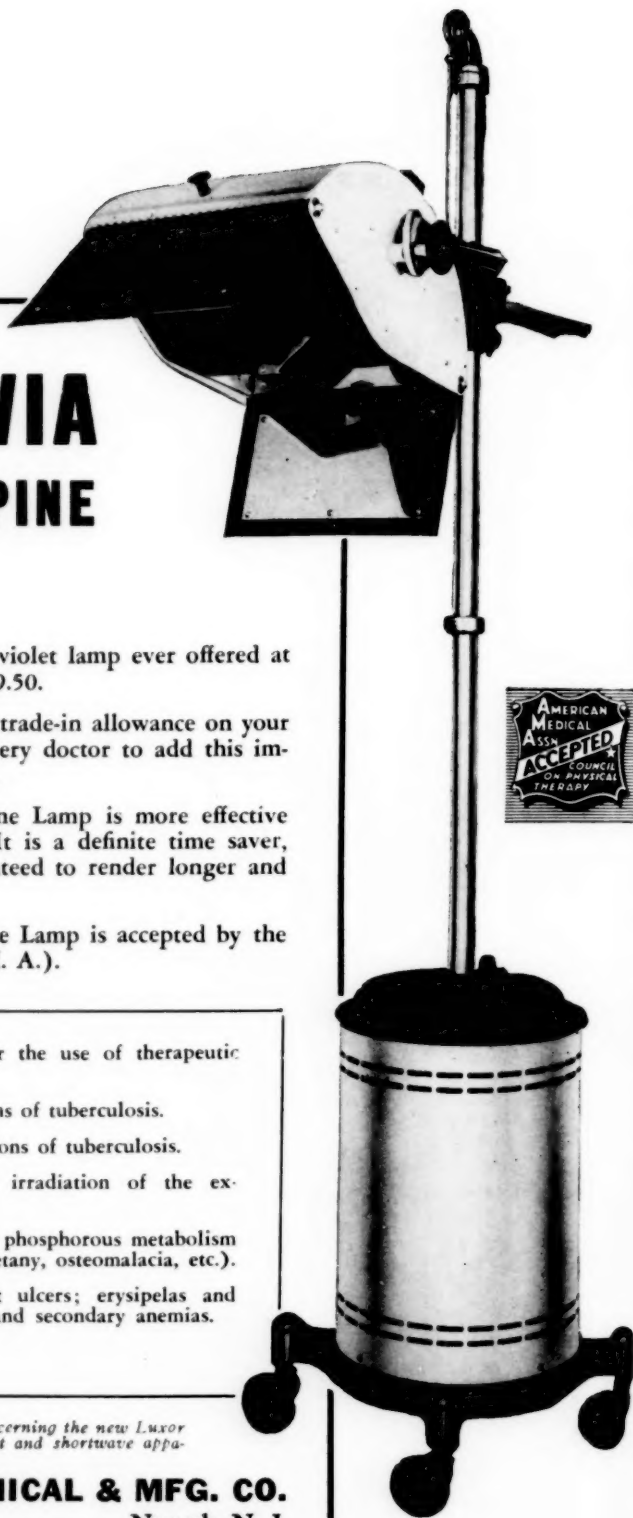
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SHORT WAVE DIATHERMY IN CHRONIC PROSTATITIS (PRELIMINARY REPORT) *

DONALD K. HIBBS, M.D.

CHICAGO

The use of heat in the treatment of prostatitis has been long familiar to physicians. Various means and methods have been resorted to as aids in the management of this chronic condition. Many authors and inventors with varying degrees of ingenuity have proposed methods and claimed results with innumerable types of instruments and devices. Urologists in general have found it advisable to adopt a procedure which they feel is the simplest, easiest, and most economical for the general run of patients. The commonest methods of applying heat to the prostate and vesicles are: (1) Hot water by sitz baths or rectal douches; (2) circulating water by means of a psychrophore or the Elliott machine; (3) electrical current utilizing rectal, pelvic, abdominal or urethral electrodes, and recently by short wave diathermy.

Schmidt, Beazell and Ivy¹ have shown by experimental study in the dog, that short wave diathermy increases the blood flow of the intestine and colon. Body temperatures of 41.5 C. induced by diathermy had no effect on secretory activity. Coulter and Osborne,² in a comparative study of pelvic heating, found that the electromagnetic field gave the most comfortable treatment to the patient and produced the highest temperatures. Beard³ was of the opinion that there seems to be no advantage of any one short wavelength over another in the heating of living tissue.

Since it had been shown experimentally that the electromagnetic field raises the temperature of tissues and increases the circulation to the part, we endeavored to obtain an evaluation of the clinical benefits of such a procedure. It is well known that in a large percentage of cases of chronic prostatitis we are able to obtain a culture from the secretion. Sanner⁴ in 300 cases was able to culture 64.9 per cent while 35.1 per cent were sterile. Mortimer and Osborne⁵ in a review of the literature and from their own observations do not agree with the claim of specific biologic action of high frequency. Eidinow⁶ failed to demonstrate any direct bactericidal action apart from that due to heat. It was manifestly impossible to demonstrate an increase in circulation to the prostate and vesicles, but we were able accurately to measure a rise in temperature in the prostatic urethra. Dark⁷ found that after short wave diathermy had been applied to the bladder region for thirty minutes, the temperature of the urine voided immediately after treatment was raised 4.6 c. over that voided immediately preceding treatment.

To all physicians who treat chronic prostatitis by the tried and accepted method of massage, two points are of paramount importance; namely, establishment of drainage from the affected part and increase in circulation in the local blood vessels. Massage unquestionably insures drainage, and friction on the mucous membrane of the rectum over the prostate probably increases its circulation for as long as the treatment is applied. In some subacute cases, if too vigorous massage is employed, it may give rise to an increased congestion of the gland, a stirring up of the infection (particularly if accompanied by urethral manipulation) with disastrous local or even sys-

* Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 13, 1938.

temic results. In acute prostatitis we do not attempt to force a canal for drainage by massage, but we endeavor to assist the prostate by rest and the application of heat. In a series of 49 cases of chronic prostatitis that were under routine treatment at the Illinois Social Hygiene League we have endeavored to obtain some information: (1) as to the value of short wave diathermy in chronic prostatitis; (2) the optimum time as well as degree of intensity of the treatment and (3) the resulting rise in temperature of the prostatic urethra.

Milliken⁸ has stated that the degree of heat in the prostate cannot be definitely estimated, for a thermometer in the electrode cannot register correctly the temperature in the tissues. The method we employed was devised by Osborne⁵ of the department of physical therapy of Northwestern University Medical School. The procedure was as follows:

The thermocouple was made of a copper and constantan wire. Two 8 gauge, double cotton covered ones were soldered into a cup ferrule. The wires were protected by a rubber tube which fitted closely to the ferrule and was about a 16 F. The thermocouple was connected to the potentiometer. The patient was placed prone on the table and under sterile precautions the thermocouple was passed beyond the sphincter of the membranous urethra to the prostatic urethra and a reading was taken. He was then given his treatment and another reading taken in the same manner. In all cases we found a rise in temperature of the prostatic urethra. As the thermocouple itself is influenced by short wave diathermy no treatments were given with the thermocouple in place and no readings were taken until the machine was disconnected.

The instrument used was the inductotherm with the 20 cm. disk electrode which was first described and evaluated by Merriman, Holmquest, and Osborne.⁹

On the first visit the patient's history was taken, he was examined for discharge and stricture, and the two-glass urine test was made. Rectal examination and prostatic massage were done and the prostatic smear examined. He was then placed on treatment. No further prostatic massage nor urethral manipulation was employed until after he had finished the prescribed course of treatment when his prostate was again examined and for a third time after one month's rest. He was examined for discharge and the urine was observed before each treatment.

Method

The patient was asked to remove all metal objects as money or belt buckles from his clothing. A towel was placed between the scrotum and thighs and the patient then seated himself fully clothed on a wooden chair which had been previously placed over the pancake electrode. The current was introduced and the patient remained comfortably seated until the end of the treatment. The patients treated by this method were not selected but were the usual run of clinic patients that had been treated by the usual methods of massage and sounds over various lengths of time ranging from three months to ten years.

In an attempt to correlate our clinical results and compare them with the degree of temperature of tissue reached, together with the increase in circulation of the parts, we divided our patients in various groups.

Four cases were treated every day for ten minutes with the apparatus set at the 100 mark of the meter or full capacity. These men had been treated from one to seven years by massage and injections. All complained of pain around the genitals and one had burning on urination. The prostatic

smear showed from twenty to one hundred per cent pus before treatment. One man failed to return after eight treatments. The other three were treated for one month, and all showed a marked decrease in pus cell content and an increase in lecithin. All felt generally improved. There was no change in their urinary symptoms or white count. No temperatures were taken in this group.

Three patients were treated for fifteen minutes at the 100 mark. These men stated that after a month's treatment, their symptoms of suprapubic pain, pain on voiding, and morning discharge had disappeared. In only one was there an increase of pus cells on massage, but a check one month later showed a definite increase. There was no change in the white count or urinary frequency. The average temperature before treatment was 99.6 and after treatment 100.7, showing an average rise of 1.1 F.

Four cases were treated once a week for thirty minutes at the 60 mark or three-fifths the full capacity of the apparatus, and while all admitted a feeling of general well being, no demonstrable change in their condition was found. The average rise in temperature for two patients of this group was 1.05 F.

Fifteen cases were treated once a week at the 80 mark for thirty minutes. These men had been previously treated by massage and injection one to ten years. All patients stated that they felt the treatment had benefited them. One showed a marked increase in pus content on massage while the other fourteen showed a decrease in the number of pus cells. Of the fourteen, eight revealed prostatic smears with five per cent pus or less, but only three of these returned for a further check one month later when the pus content of the fluid was found to be still below five per cent. All irritating complaints as suprapubic pain, morning discharge, pain in the pelvis, burning on urination disappeared under treatment. Again no change in the white count or urinary frequency was noted. First and second urines were unchanged. The intraurethral temperatures of four cases in this group averaged 99.2 before treatment and 100.9 after treatment, indicating an average rise of 1.7 F.

Four men were treated once a week for thirty minutes at the 90 mark and after one month showed a diminution of twenty to thirty per cent in pus cell content of the prostatic smear with a marked increase in lecithin, and all claimed to feel improved. No other change in their condition was noted. No temperatures were obtained in this group.

Five cases were treated twice a week for twenty minutes at the 80 mark. All symptoms of pain and burning were relieved but in two of the five cases the pus content was increased, in two it was reduced by fifteen per cent and in one it was unchanged. Records of temperature taken in two of these cases revealed an average before treatment of 98.6 and after 100.5 showing a rise of 1.9.

Twelve cases were treated twice a week at the 90 mark for one month. Again irritating pain was relieved. All patients asserted they were improved. There were no changes in urinary frequency. In four cases the pus content was unchanged. In four it was reduced fifteen per cent and four cases showed an increase in pus content after one month's treatment. The temperature of eight of these cases was taken before and after treatment showing an average rise from 99.5 to 101.6 or 1.56 F.

Coulter and Osborne¹⁰ warn that burns can be produced by short wave diathermy, but in their experience are not frequent. We had no burns in this short series.

Discussion

Conclusions drawn from a series of forty-nine cases appear to us to be of little value. Three different periods of treatment at varying intervals of from one to seven days were used in this clinical experiment. In addition four different intensities of current were utilized. Our results were as follows:

In the cases in which the temperature was taken the greatest rise occurred at the end of twenty minutes of treatment with the apparatus set at four-fifths of its total capacity. With the apparatus at nine-tenths capacity for twenty minutes the temperature rise was within four-tenths of a degree of the maximum obtained. It seems warranted to state that the more current generated up to twenty minutes the higher will be the temperature obtained. If we take the conclusions obtained by Schmidt, Beazell, and Ivy as to the greatest circulation, it would seem that circulation and temperature were at an optimum at the end of a twenty minute period. Clinically all patients on short wave treatment were relieved of their complaints at the end of their treatment period. There was no significant change in their oral temperature, white count, or urine. Of the total cases treated 28, or 57 per cent, showed a decrease in pus cell content in the prostatic smear and a definite increase in lecithin. Seventeen, or 34 per cent, showed an increase in pus content and decrease in lecithin or exhibited no change, while four cases, or 8 per cent, did not complete their course of treatment. We are not yet convinced that drainage from the prostate is benefited to any great degree by this therapy. Further investigation is necessary to fully evaluate this method of treatment in chronic prostatitis-vesiculitis although from this preliminary investigation we believe it to be a valuable adjunct in managing this condition. It is suggested that the patient with chronic fibrous prostatitis is benefited more than one with the follicular type.*

References

1. Schmidt, C. R.; Beazell, J. M., and Ivy, A. C.: Effect of Heat Applied by the Elliott Treatment and Short Wave Diathermy on Blood and Lymph Flow of Intestine and Colon, *Arch. Phys. Therap.* **18**:677 (Nov.) 1937.
2. Coulter, J. S., and Osborne, S. L.: A Comparative Study of Pelvic Heating, *Arch. Phys. Therap.* **17**:135 (March) 1936.
3. Beard, G.: Short Wave Medical Diathermy, *Physiotherap. Rev.* **16**:100 (May-June) 1936.
4. Sanner, J. E.: (Personal Communication from the Author).
5. Mortimer, B., and Osborne, S. L.: Tissue Heating by Short Wave Diathermy, *J. A. M. A.* **104**:1413 (April 20) 1935.
6. Eidinow, Albert: Discussion on Short Wave Diathermy, *Proc. Roy. Soc. Med.* **28**:307 (Jan.) 1935.
7. Dark, E. P.: The Inductotherm, *M. J. Australia* **2**:397 (Sept. 19) 1936.
8. Milliken, Lorenzo F.: The Treatment of the Chronically Infected Prostate, *Pennsylvania M. J.* **39**:791 (July) 1936.
9. Merriman, J. R.; Holmquest, H. J., and Osborne, S. L.: New Method of Producing Heat in Tissues, *Am. J. M. Sc.* **187**:677 (May) 1934.
10. Coulter, J. S., and Osborne, S. L.: Physiologic and Chemical Effects of Short Wave Diathermy, *J. Med.* **18**:283 (Aug.) 1937.

Discussion

Dr. Norman E. Titus (New York): Dr. Hibbs is to be commended for his painstaking study, and I feel that his critical evaluation of short wave treatment in prostatitis is as valuable as those of a positive nature. The report has an objectivity that deserves serious consideration. The art of electrotherapy cannot be practiced with a single agent. Too many

of our profession have grasped at short-wave diathermy as a convenient short cut in electrotherapy, when they want to induce heat in the body. They disregard the aggregate of centuries of clinical observations by electrologists all over the world, as to the efficiency of ordinary diathermy when indicated.

When conventional diathermy is ap-

* The author wishes to express his appreciation to Mr. S. L. Osborne of the Physical Therapy Department of Northwestern University for his interest and cooperation in this work.

plied to the prostate it is possible to know how much energy is going through the tissues. This has been proved a successful method. In chronic prostatitis however, heat in the form of diathermy of either variety, is not sufficient. Massage or the static wave current is indicated for the production of mechanical drainage.

Dr. Diraeli Kobak (Chicago): I am sure I voice a general impression that no specialty in modern surgery has been more progressive and contributed more original ideas and techniques for the welfare of humanity than has urology. Modern workers in this field have transformed and raised the stature of this practice to a height which lends dignity to their calling and elicits respect and admiration from all their colleagues. That they have kept abreast with and took advantage of the electromechanical innovations is well recognized when it is recalled that they had the courage and vision to be among the earliest to perfect illumination of the bladder, and transurethral extirpation of neoplastic processes by electrosurgery. A pioneer who had such vision, courage and dexterity, is Dr. Kolischer, a former President of this Congress and the dean of Chicago urologists, whose original contributions we recall with pride. His work has given impetus to further not only the scientific advances of electrosurgery but the study of the medical possibilities of classic and its more potent counterpart, short wave diathermy.

Dr. Hibbs' report is a conservative and critical evaluation of the clinical possibilities to which short wave diathermy and one of its component methods (electromagnetic induction) could be applied for the deeper heating of the prostate. Any question of deep heating has been answered by him with proof that a thermocouple passed through the urethra beyond the sphincter demonstrated a rise in temperature of the prostatic urethra above the reading taken before treatment. This must be considered a basic fact because it substantiates the observations of others that heat can be created within the deeper tissues by short wave current. No less impressive are his clinical data, because they show that unselected cases of chronic prostatitis can be relieved from suprapubic pain, tenesmus and a reduction of the pus cell content by a technique the simplicity of which is a tacit recommendation for its further study as a procedure of great promise.

It is unfortunate that the essayist did not have at his disposal an exact dosage reading control in terms of wattage input to the patient and was thus forced to resort to a set of arbitrary figures on the dial of his apparatus which tends to confuse an important factor of his study. His experiments with settings of 60, 80, 90 and 100 convey information subject to challenge in the court of science. For instance, if one attempted to duplicate his experiments on another type of apparatus or one of a different wavelength, or on the same apparatus with mixed types of individuals, such as fat, lean, and the like, it is fairly certain that the results would be as different as the types of apparatus employed. Today this difficulty has been obviated by means of the dosimeter introduced by Mittelman. In attempting to analyze the arbitrary figures just mentioned by means of this dosimeter, I found that the setting "60" on the type of apparatus used by Dr. Hibbs emitted an energy input into the subject of 48 watts, under the test conditions used, and likewise the arbitrary marks of "80," "90," and "100" introduced 68, 69.5 and 72 watts, respectively. From this it was computed that the difference in energy output of mark "60," "80" and "90" approached 33.3, 5.5 and 3.4 per cent as compared to the power at the "100" mark setting. The striking and significant fact of this finding is first, that this apparatus delivers more than sufficient energy in calories to produce physiologic responses, and second, that the settings or markings of "80" and "90" approach the maximum power transmission by 5.5 and 3.4 per cent. It is of clinical interest also to note that a 33.3 per cent reduction of power failed to produce any favorable effects, but explains why the marks of "80" and "90" on the dial approached the clinical results of the "100" mark. Such a potent source of energy as this should be measured in the same precise manner as dosage in drug therapy. Its neglect is an imputation of indifference and a challenge to our scientific progress. Treatment under proper dosage control of a large series of cases has forced me to revise my opinion about the need of instruments with very large wattage output. The problem of the future in short wave therapy is not the blind employment of massive wattage emitters but rather the intelligent use of sufficient power output under proper dosage control to produce thermic effects within physiologic limits.



ELECTROSURGICAL MANAGEMENT OF BLADDER NEOPLASMS *

HARRY CULVER, M.D.

CHICAGO

The present discussion of the electrosurgical management of bladder neoplasms will be limited to tumors of epithelial origin, which group comprises all but a very few in any series of vesical growths. In a consideration of neoplasms of the entire body, those of the bladder are not rare, being approximately 2 per cent of the total.

Epithelial bladder tumors have been given many classifications both by clinicians and pathologists, but for the purposes of this clinical discussion I shall consider them in three groups: (1) papilloma, a microscopically and clinically benign tumor, but potentially malignant; (2) papillary carcinoma; (3) infiltrating carcinoma. Obviously the last two groups may be differentiated only by gross morphology and microscopic structure as both infiltrate, and both have varying degrees of malignancy as determined by clinical behavior and by the microscopic variations of their cells (Broder's); however, it has been repeatedly observed that the prognosis in general is better with papillary carcinoma than with the flat, often ulcerating infiltrating growths.

An element not apparent which does not permit early determination, is often a factor in the future of any one of these neoplasms of any group. I refer to the individual capabilities of the tissues of the host in resisting growth and invasion of new growths of this type. Why does a benign papillary growth in one person go on for many years as such, while in another person of the same age and in apparent general health, very early becomes a malignant infiltrating growth? Likewise the response to the same type of treatment of malignant tumors, morphologically and microscopically similar, is too variable to be considered the result of minute variations in technic.

Studies made of the development of anilin tumors of the bladder and observations of early development of new tumors in a bladder under cystoscopic study after the removal of a primary growth, tend to show their origin about the terminal capillaries of the basal layers of the bladder mucosa. This fact serves to emphasize the possibility of a circulating tumor-producing substance in the blood, or a pre-existing anatomic condition as the exciting cause of these growths. The presence of associated bladder lesions which make for chronic irritation of the mucosa are not encountered with sufficient frequency to be considered an important factor in the exciting cause. It is therefore logical to consider, in a measure, a constitutional factor as having some bearing on the presence and outcome to a bladder tumor with or without proper treatment.

Statistical Data

I wish to present pertinent data obtained by the study and management of 136 patients with bladder tumors under my personal management. Ninety-nine of these patients were in St. Luke's Hospital during the last ten years and thirty-eight were in the Cook County Hospital during the last five years. Since the pathologists at both of these institutions do not classify bladder tumors microscopically according to Broder's classification, i. e., classifying the grade of malignancy, this feature cannot be considered. This series in-

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cludes epithelial tumors of all three types which naturally precludes any value to a presentation of results of treatment.

As to sexes this series runs true to form, in that there were 104 males and 32 females, making approximate ratio of three males to one female which is the general average.

The ages in decades (table 1) finds a gradual increase in both sexes from the second to the fifth, and then a gradual decrease. Thus, in the male group 35 per cent of the patients were between 50 and 59 years of age inclusively, while almost 47 per cent of the females were between this age limit. Together 38 per cent of these patients were between 50 and 59 years of age.

TABLE 1. — *Incidence of Age and Sex*

Age in Years	Males	Females	Totals
20 - 30	2	1	3
30 - 40	11	1	12
40 - 50	14	2	16
50 - 60	37	15	52
60 - 70	21	12	33
70 - 80	19	1	20
	104	32	136

An important finding, which has a considerable influence in determining the type of surgical treatment to be undertaken, is the number and location of the tumors within the bladder. In this series there were 88 single tumors primarily and 49 patients with multiple tumors. However, follow-up cystoscopic studies revealed 17 recurrences, presumably at the site of the primary growth and 14 patients developed tumors in other parts of the bladder. It would be valuable to know whether these 17 so-called recurrences were actually a continuation of growth of the primary tumor or were, in fact, new tumors. The 14 patients with new tumors developing in distant parts of the bladder tend to suggest the continued presence of a tumor-producing agent in a susceptible bladder rather than secondary tumors by transplantation, as in some of them there were years intervening. Two of these new tumors were in line with a cystotomy incision following treatment of tumors of the base which strongly suggests transplantation, however, a third such growth followed suprapubic prostatectomy with bladder stone and it was in the only tumor in the bladder. A study of the Bladder Tumor Registry of the American Urological Association, where grades of malignancy are regularly made, shows that 46 per cent of the single tumors were low-grade (grade I or II) while 63 per cent of the multiple tumors were of this grade, therefore this factor of multiplicity of tumors should be considered more than a casual observation.

When it has been decided that a bladder tumor is to be treated by electrosurgery, its site within the bladder is sometimes a determining factor in the type of operation used. Whether there is involvement of the bladder neck and trigone, the base at or near the ureteral orifices, or confined to the lateral walls or vault, obviously at times demands variable surgical procedures. Table 2 gives the sites of the tumors in this series of 136 patients when the diagnosis was first made.

Since some of these were of long standing when first seen, extension and multiplicity prevents the possibility of correct location of the original growth, as evidenced by the number grouped under "entire bladder wall" invasion. When diagnosed, a total of 80 per cent of these patients had growths near the ureteral or urethral orifices, which speaks for the relative infrequency of tumors available for radical resection when all other influencing factors are favorable.

TABLE 2. — *Site of Tumors in the Bladder*

Base (near one or both ureteral orifices).....	74
Lateral and posterior walls.....	23
Vesical neck and trigone.....	23
Vault.....	6
Entire bladder wall.....	11

(All of the above areas with some growth.)

In order to emphasize a point relative to the initial symptom and the time elapsing before a diagnosis was made, there is a grouping (table 3) of symptoms, early and late, of the two symptoms most commonly presented.

TABLE 3. — *Data on Two Most Common Symptoms*

Hematuria —	Bladder Irritability —
First symptom96	First symptom36
Only symptom47	Only symptom7
Secondary symptom27	Secondary symptom48
Total hematuria123	Total bladder irritability.....84

There were five tumors not producing symptoms, but were casual findings at cystoscopy for ureteral stones, bladder stone and urethral strictures.

That all epithelial tumors of the bladder are potentially or actually malignant there is no question. The chance of effecting a cure depends to a considerable extent upon the stage of their unhindered progress when first encountered. To be sure, there are other pertinent factors in this connection, but I think there could be no disagreement with the statement that the earlier the diagnosis the greater is the chance for a cure. There are found to be two principal causes for failure of sufficiently early diagnosis in many patients; the disregard of the patient for important symptoms, especially hematuria, and the procrastination of the physician who first sees some of these patients and does not immediately demand adequate diagnostic study.

A study of 129 records of patients (table 4) in this series representing all types of bladder tumors offers some important data relative to the time elapsing between the first symptom and the making of the diagnosis.

TABLE 4. — *Time Elapsing Between First Symptom and the Diagnosis*

Three months or less.....	37
Between 3 and 6 months.....	22
Between 6 and 9 months.....	13
Between 9 months and 1 year.....	17
Two years.....	18
Three years.....	2
Four years.....	6
Five years.....	6
Six years.....	3
Seven, ten, sixteen, seventeen and twenty years.....	1 each
Casual finding.....	5

The finding of but 35 per cent of immediate diagnoses and of only 69 per cent diagnosed within the first year after the initial symptom, presents a picture which helps explain the end results in the management of any important number of patients with bladder tumor.

Associated and complicating urinary tract lesions may be secondary to the presence of the tumor, and others incidental. None, however, can logically be considered important factors in the cause.

Many of these patients were seen before intravenous urography was available, and since that time many have shown varying degrees of hydro-

nephrosis and unilateral non-visualization, but this material is not sufficiently complete to be of statistical value.

TABLE 5 — *Associated Lesions*

Hypertrophy of prostate.....	22
Median bar	16
Pyelonephritis (acute)	3
Urethral strictures	3
Pyonephrosis	10
Bladder stone	1
Ureteral and renal stone.....	3
Diverticulum of bladder.....	1
Interstitial cystitis	1
Vesico-vaginal fistula (spontaneous).....	2

Modern Treatment

Modern treatment of bladder tumors really began with Beer's epoch making work and introduction of cystoscopic electrocoagulation in 1910. The necessity of understanding more of the intricate problems of growth, local and associated pathologic processes, and the natural history of bladder tumors became evident at once as a need for deriving the maximum benefits from this discovery. From this stimulus for study of bladder tumors and the constant improvement in electrical equipment, we have reached the present status in the electrosurgical management of these growths.

The term diagnosis when used with reference to bladder tumors includes much more than the mere presence of a growth, and all available diagnostic aids must be carefully and routinely used to obtain the maximum of information about this growth and its host. While a carefully performed cystoscopic examination, under local, sacral or even low spinal anesthesia usually is the outstanding diagnostic procedure, it sometimes leaves much to be desired. An experienced cystoscopist, in a majority of cases, will be correct in his appraisal of the character of the growth, i. e., whether benign or malignant, but the necessity of further data in some borderline cases is apparent, as the exact character of the growth will determine the surgical treatment to be instituted. A routine biopsy specimen of all but the very obvious benign growths, while not universally obtained, is a valuable procedure which often gives important information and does not increase the hazard to the patient. Multiple biopsy specimens may be necessary or at least a large enough specimen taken to include tissue from all elements of the growth.

Cystography likewise sometimes adds information which when applied with other findings serves the surgeon in good stead in making his decision for a procedure. The extent of bladder wall infiltration may thus be visualized much more accurately than by cystoscopy alone. Cystoscopy may be unsatisfactory or impossible but cystography here may reveal information not available by any other conservative method.

That there is a decided upper urinary tract damage caused by tumors of the bladder has long been known, but the frequency of this complication and its extent has only been apparent since the introduction of intravenous urography. It is an obvious mechanical fact that growths involving the lips of either ureteral orifice will have a relative obstructive effect above, but when no apparent obstruction is recognized by cystoscopy and the tumor is judged to be centimetres away from the orifice many surprising upper urinary tract lesions are uncovered by routine intravenous urography. Varying degrees of ureteral and pelvic dilatation are found and occasionally non-visualization is noted under these circumstances. I feel that an intravenous

urographic study should be a routine measure in the diagnosis of every bladder tumor. No doubt this would sometimes have an important bearing on the type of early treatment to be instituted and demand attention to the upper urinary tract in follow-up observation and treatment in others.

Ureteral catheterization and retrograde pyelograms may be safely done for many of these patients, but it would be hazardous for others and impossible in some. Intravenous urography usually suffices in supplying the needed information.

Surgical Management

After a complete diagnosis along the lines indicated above and careful vaginal and rectal palpation, experience would separate bladder tumors into several relatively definite groups for their surgical management.

1. Transurethral electrocoagulation should be used for obviously benign growths, excepting those in inaccessible positions or too large. This same method may be successfully used in certain pedunculated small growths with the pedicle not involved but tissue from the branches microscopically proved malignant, however it is in this group where one must change from this closed method to the more radical open method when it is observed that satisfactory progress is not being made. This usually can be determined after the first transurethral application.

2. Electrocoagulation through a cystotomy has been largely replaced by transvesical or loop resection of the main tumor mass with electrocoagulation of the base. It is used for large tumors mostly on the base or neck, those judged to be impossible to remove by transurethral electrocoagulation because of size, inaccessibility or degree of malignant involvement. It is this group which now is frequently managed by transurethral resection by operators especially qualified in this procedure; however, unless the necessary skill and experience in this procedure is certainly available an open operation and loop resection is advisable in most tumors of this group. Large pedunculated tumors without infiltration of the base may conveniently be managed by excision of the base and electrocoagulation.

3. Infiltrating tumors of the lateral and posterior walls or the vault may be suitable for segmental resection. While this is a formidable procedure and carries a considerable surgical risk, in properly selected patients this is not prohibitive when the possibilities of complete eradication of a malignant growth are considered. Obviously in a debilitated, anemic patient, with poor renal or cardiac function or with any patient with clinical or roentgenologic suspicion of metastases this procedure does not apply.

Since this series of 136 patients was treated during the last ten years, a composite picture of the type of treatment instituted should reveal a fair cross section of treatment in general during this period, however individual preferences for a certain method of treatment for a certain type of tumor will vary greatly.

TABLE 6. — *Types of Treatment*

Fulguration (cystoscopic electrocoagulation).....	47
Diathermy (cystotomy and electrocoagulation).....	11
Loop resection (cystotomy and electroresection).....	29
Segmental resection (removal of tumor bearing segment).....	20
Excision of tumor (electroresection of base of pedunculated tumor and electrocoagulation of bladder wall).....	14
Permanent cystostomy	3
Transurethral resection	2
Bilateral cutaneous ureterostomy.....	4
Ureterostomy and cystectomy.....	2
Uretero-sigmoidostomy	1

That multiple operative procedures were used on some patients is obvious, and table 6 represents either the only procedure used or the last one. Before such a radical operation as segmental resection was undertaken some had had previous coagulation, loop resection and in two instances fulguration years before. Others were treated by fulguration and this having been found inadequate, later were managed by coagulation or loop resection.

As the situation stands at present with increasing attention being given to the various methods of irradiation and the more conservative electrosurgical procedures in combination with irradiation, patients are very infrequently seen where such a radical procedure as cystectomy would apply. Unless there be a pronounced broadening of the indications for this operation, certainly the number performed will be small and when performed after utero-sigmoidostomy it will be very much smaller. In this series cutaneous ureterostomy was carried out on six patients, four times for palliation and two times followed by cystectomy. There was marked ureteral dilatation in all.

Radium in any form has not been regularly used, but since adequate equipment for radiation by deep roentgen rays has been available, malignant tumors routinely received either preoperative or postoperative radiation. This treatment has its advantages and disadvantages as a preoperative procedure, it tends to reduce the size and activity of the growth, helps control bleeding and perhaps, in a measure, controls metastases. On the other hand it alone cannot cure and must be followed by some operative procedure in most cases. Since the cumulative effects of this treatment last five to six weeks, before which no operative work should be done, this period of waiting is sometimes a trying one for all concerned, and principally because of this I now prefer postoperative radiation which is regularly used for all malignant growths, regardless of the type of surgical treatment used. Granting that the type of treatment has been correctly selected and properly performed, one can expect from postoperative radiation a prevention of new tumors not now apparent and varying degrees of control of any remaining elements of the primary tumor, this variation depending upon the cellular character of the growth.

Many advances have been made and are still being made in our knowledge of malignant tumors of the urinary bladder. Even with the material as it presents itself today the results of management by combined procedures offer much to those whose growths are still local and have not yet caused important changes in the upper urinary tract. With our present facilities for diagnosis and treatment there cannot be expected any outstanding improvement in the number of cures reported, until there is a more general understanding among the people of the possible significance of important and easily recognized subjective symptoms. When only 35 per cent are diagnosed immediately after the initial symptom and less than 70 per cent within the first year of the initial symptom of a series of 136 patients, two-thirds of whom were private patients of better than average intelligence, there must be something lacking in our methods of lay education in this regard. Development in our specialty along this line must be considered as an important factor in the further advancement in the management of this disease.



A LOW TEMPERATURE TECHNIC FOR ARTIFICIAL FEVER INDUCTION *

MALCOLM M. COOK, M.D.

MINNEAPOLIS

The body temperature represents a balance between heat production and heat loss.¹ Heat production is dependent upon two main factors: (1) Heat generated by metabolic or oxidative processes within the body, and (2) heat received by the body from the environment. Heat loss normally takes place through three main channels:² (1) Radiation of heat to cooler objects in the environment; (2) convection (and conduction) through direct contact with the enveloping atmosphere; and (3) evaporation of moisture from the skin and lungs.

Physiologists³ point out that natural fever depends more upon impairment of heat loss than increase of heat production. Thus, according to Hardy⁴ an athlete during extreme muscular exertion may generate 10 to 12 times his basal heat output yet his heat loss mechanism compensates for this 1000 per cent overload and no fever results. On the other hand, most of the circumstances of fever tend toward basal conditions, i.e., inactivity, starvation, etc. True, there is a rise of metabolic rate³ of about 7 per cent per degree of fever, but this is less than the metabolic increase which normally follows the ingestion of a protein meal³ (40 to 60 per cent). Also the rise from fever follows the temperature rise as a result rather than a cause.

Basis of Heat Production

Efforts to produce artificial fever by a process which ignores the body's enormous capacity for heat loss generally fail completely or encounter complications from the excessive energy input required. The more successful devices for inducing artificial fever primarily insulate the patient's body against heat loss and secondarily add energy in some form to speed up the body temperature rise. The better the heat insulation is carried out the more efficient is the apparatus regardless of whether the added energy is offered in the form of electromagnetic induction or as direct heat.

In fever apparatus radiation of heat is prevented when the walls of the cabinet occupied by the patient are at a higher temperature than that of the patient. Convection (and conduction) losses likewise cease when the surrounding atmosphere exceeds the patient's systemic temperature. Evaporation of surface moisture, however, can occur regardless of the air temperature so long as the atmosphere is less than 100 per cent saturated with water. This evaporation loss (together with heat lost from the patient's exposed face and head and by vaporization from the lungs) is considerable and accounts for the excess energy which must be added to attain and maintain artificial fever in the patient.

By operating the convection or air-conditioned cabinet type of apparatus at 100 per cent relative humidity, all three important avenues of heat loss are controlled and very little excess energy is needed to elevate the patient's temperature easily and quickly. Therapeutic fever levels of 105 to 106 F. or over can be attained in an hour or less with cabinet air temperatures as low as 115 and even 110 F. and can be maintained at cabinet temperatures only a few degrees above the fever level.

* From the Department of Radiology and Physical Therapy, University of Minnesota, Minneapolis, Minnesota.

* Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1938.

Low Temperature Technic

Low temperature, high humidity operation reduces the heat interchange to such a point that the patient's skin temperature does not greatly exceed the systemic temperature even during fever induction. Many of the complications encountered by early workers with artificial fever are now recognized as being associated with high skin temperatures. Thus with lower skin temperatures patients are more comfortable and sedative requirements are correspondingly reduced. The incidence of skin burns and erythema is markedly lessened. With low skin temperatures pulse rates remain moderate even during the fever induction. Sweating is reduced, which conserves the body's salt and water, maintaining more nearly normal blood volume and lessening the incidence of vascular collapse or shock. The tendency for the patient's temperature to overshoot the intended level disappears when excessive skin temperatures are avoided. These advantages are especially appreciated when very young or old or debilitated patients must be treated.

One hundred per cent relative humidity is difficult to attain in conventional fever apparatus, but a few minor alterations will accomplish the purpose. Radiant or dry heaters are disconnected as they are not used. All heat is obtained from an electric water vaporizer of the immersion type of 1000 to 1200 watts capacity. The container is well insulated against heat loss by conduction. Thus virtually all the heat imparted to the apparatus is applied in the form of latent heat of vaporization and is transferred to the cabinet walls and to the patient by condensation of supersaturated moisture with liberation of its latent heat of vaporization. Under these conditions air temperature in the cabinet cannot exceed the dew point and 100 per cent saturation is accomplished automatically for any desired temperature. Further heating can only take place as more water vapor is added. When cooling occurs the moisture capacity of the air reduces and moisture precipitates, releasing latent heat and tending to prevent sudden fluctuations in the box temperature.

Temperature control of the cabinet must be very precise at high humidities. Obviously a humidistat is not the proper type of instrument to employ, so this troublesome device is eliminated. A wet bulb thermostat would serve by operating according to the wet bulb temperature of the cabinet. But at 100 per cent humidity wet bulb and dry bulb temperatures are equal, hence a dry bulb thermostat controlling an immersion vaporizer is all that is necessary to attain and maintain desired cabinet conditions.

Waterproofing of non-metallic cabinets may be necessary and can be accomplished by painting the interior with aluminum paint. Corners and seams may be sealed with battens screwed at frequent intervals. A small fan is desirable to secure slight motion of the air in the cabinet. Our own apparatus is a cabinet of the Kettering Hypertherm type, modified as outlined to operate at high humidities. The same principles apply equally well to apparatus of other types, either convection cabinets or the electromagnetic induction variety.

Some kind of electrical thermometer is desirable for continuous indication of the patient's rectal temperature so as to avoid frequent opening of the cabinet. No covering of any kind is necessary over the patient. The problem of skin maceration at high humidity fails to materialize, being no worse than that seen after a hot bath. Both operators and patients who have had experience with both types of apparatus express appreciation for the low temperature, high humidity technic for its added safety and comfort.

The following tables illustrate the effects of low temperature induction in high humidity cabinets, the rapid induction in spite of the low initial cabi-

net temperature, moderate pulse and percentage of humidity attained. In contrast to the robust patient in table 1 treated for gonorrhea, the individual in table 2 is emaciated, bedridden and in poor physical condition treated for chorea.

TABLE 1.—*First Three Hours of Typical High Fever Treatment (for Gonorrhea) in a Robust Patient.*

Time	Fever	Pulse	Resp.	—Cabinet Temp.—		Humid.	Remarks
				Dry B	Wet B		
8:00	99.0	82	20	106	106	100%	Nembutal gr. iii 200 cc. 3% NaCl
8:15	99.5	88		109	109	100%	
8:30	101.0	112		111	111	100%	
8:45	103.5	116	36	114	114	100%	Morph. Sulph. gr. 1/6
9:00	105.4	132		116	116	100%	
9:15	106.6	132		115	115	100%	
9:30	106.7	128	32	115	115	100%	1000 cc. 3% NaCl
9:45	106.5	136		110	110	100%	
10:00	106.7	136		108	108	100%	
10:15	106.3	128	36	109	109	100%	
10:30	106.3	128		109	109	100%	
10:45	106.4	128		110	109	98%	
11:00	106.2	132		109	109	100%	

(Etc., continuing as above for remainder of six hour treatment)

TABLE 2.—*First Three Hours of Typical Moderate Fever Treatment (for Chorea) in Emaciated Bedfast Patient.*

Time	Fever	Pulse	Resp.	—Cabinet Temp.—		Humid.	Remarks
				Dry B	Wet B		
8:15	99.0	80	20	116	116	100%	Nembutal gr. ii 200 cc. 3% NaCl
8:30	100.4	88		116	116	100%	
8:45	101.5	100	24	116	116	100%	
9:00	103.0	132		113	113	100%	
9:15	104.5	152	40	110	110	100%	
9:30	104.3	148		109	109	100%	
9:45	104.3	148	44	108	108	100%	Codine Sulph. gr. 1/4
10:00	104.2	140		108	108	100%	
10:15	104.2	144	36	108	108	100%	
10:30	104.2	140		108	108	100%	1000 cc. 3% NaCl
10:45	104.3	148	32	108	108	100%	
11:00	104.2	148		108	108	100%	
11:15	104.2	136	32	109	109	100%	

(Etc., continuing as above for remainder of four hour treatment)

Summary

1. In artificial fever prevention of heat loss is more important than increased heat production.
2. Fever cabinet humidity of 100 per cent stops heat loss by evaporation and allows operation at much lower temperature ranges.
3. Low temperature, high humidity technic reduces skin temperatures, increases comfort, lowers sedative requirements, reduces pulse rates, and eliminates skin complications. Body salt and water losses are diminished, lessening the incidence of vascular collapse. Uncontrollable fever and "over-shooting" do not occur.
4. Increased safety permits extension of treatments to many patients considered poor risks for the conventional types of apparatus.
5. A fever cabinet for low temperature, 100 per cent humidity operation needs only an immersion vaporizer controlled by a dry bulb thermostat. Virtually all heat is delivered as latent heat of vaporization by condensation of supersaturated moisture in the cabinet.

References

1. Sheard, Charles, and William, M.: Investigation on Exchanges of Energy Between the Body and Its Environment, Heating, Piping and Air Conditioning 9:189 (March) 1937.
2. Hardy, James D.: Radiation of Heat from the Human Body, J. Clin. Invest. 13:593 (July) 1934.
3. Best, C. N., and Taylor, N. B.: Physiological Basis of Medical Practice, Baltimore, William Wood & Co., 1937, Chapter 54, "Body Temperature: Heat Balance," p. 984.
4. Hardy, James D.: Mechanism of Heat Loss from Human Body, Abstracts First International Conference on Fever Therapy, New York, Paul B. Hoeber, Inc., 1937, p. 16.

(Discussion on page 553)

FEVER THERAPY IN ACUTE RHEUMATIC DISEASE *

E. E. SIMMONS, M.D.

and

F. LOWELL DUNN, M.D.

OMAHA, NEBRASKA

At the First International Conference on Fever Therapy we reported the effects of physically induced fever in 15 cases of acute rheumatic fever, using the Kettering Hypertherm Cabinet¹⁻². In this communication we stressed the marked improvement in joint swelling, and the almost prompt and complete relief of pain, as these were the immediate outstanding results. At that time we commented on the possible benefits of fever therapy during the subclinical stage of active infection in rheumatic fever, feeling that if this stage could be shortened considerable cardiac damage could be prevented³.

During the past year and a half 17 additional cases of rheumatic fever have been observed along with the original group. One of the patients (P. M.) of the original group who had residual joint changes and failed to respond to fever therapy, is a proved case of atrophic arthritis for which reason she is not included. Thus we have had 31 cases of rheumatic fever under observation from one month to three and one-half years. In the second group we have been more interested in active carditis, and although the same care was exercised in the selection of cases of undoubted acute rheumatic fever, in this group severe pain and swollen joints occurred less often than formerly.

The cases reported in these two groups have been examined and observed from time to time by the various members of the Arthritis Clinic of the University of Nebraska Fever Therapy Research Department. This clinic is composed of two internists, an orthopedist, and an otorhinolaryngologist. The cases from the University of Colorado group were supervised by F. G. Ebaugh and J. R. Ewalt, and the records analyzed by the authors.

* From the University of Nebraska Fever Therapy Department, Bishop Clarkson Memorial Hospital, Omaha, Nebraska. A. E. Bennett, M.D., Director.

³ Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 15, 1938.

In the 17 new cases there were 10 females and 7 males. The ages varied from 8 to 29 years. Of this group 15 had definite findings of cardiac involvement as follows: 5 had mitral stenosis, 9 had systolic murmurs of varying degree, and 1 had a marked pulse on admission. In 2 there were no definite findings of cardiac involvement, other than increased pulse rates and markedly increased blood sedimentation rates. Six cases had choreiform movements in addition to rheumatic joints. A summary of the new cases is included in table 1.

General Comment

In the present group severe pain was a less conspicuous factor, since some were selected primarily because of active rheumatic carditis. There were 9 cases with moderate to severe joint pain. Of these, 6 cases received prompt relief from pain after one treatment. In 3 there was delayed relief, 1 (R. McK.) becoming pain-free after 15 hours of fever therapy, the other 2 having some residual pain after 14 and 18 hours of heating, respectively. The remainder of the group did not have significant pain.

Symptomatic relief from pain in acute rheumatic fever occurs almost uniformly following fever therapy. The relief is usually prompt and occurs in those patients who have failed to respond to prolonged bed rest and adequate doses of salicylates². This gives a useful therapeutic agent in a disease often characterized by a protracted course, and may be of some diagnostic value. The relief in these cases occurs at a considerably lower temperature than that which is necessary in the fever therapy of gonococcic arthritis. Also a shorter number of hours of treatment are necessary to obtain results than in gonococcic arthritis. The effects are much more striking than those usually obtained in typical atrophic arthritis. It is interesting to note that in our limited experience certain cases of fibrositis have responded to about the same degree of fever therapy as we have used for rheumatic fever, although the relief is more gradual⁴.

The interrelationship between atrophic arthritis and acute rheumatic fever is still a confusing one. Although there is clinical agreement in the recognition of the classic or originally described forms of rheumatic fever and atrophic arthritis, there is a large mixed group in which clinicians do not always agree and resort to such terms as rheumatoid, infectious arthritis, and other hybrid terminology. Viewpoints vary from considering the two conditions as independent diseases to manifestations of the same disease factors. Certainly symptoms of both atrophic arthritis and rheumatic fever are known to occur either concomitantly or to follow each other, especially in middle-aged patients with definite atrophic arthritis who at the same time have well advanced rheumatic heart disease and who give a history of repeated painful non-deforming joint attacks in early life. We have wondered whether the occasional prompt responses obtained with fever therapy in so-called rheumatoid arthritis might not be due to the same factors concerned in rheumatic fever. The usual case of atrophic arthritis which responds to fever therapy does so very slowly. This concept is not easily susceptible of experimental proof but may be of some clinical significance for the selection of cases of atrophic or rheumatoid arthritis that might be benefited by physically induced fever.

The effect of fever therapy upon the blood sedimentation rate in rheumatic fever is of importance, since often during the stage of subclinical activity it may be the only abnormal laboratory test. Rapid sedimentation rates are so characteristic of rheumatic fever, even in the subclinical stage,

TABLE 1.—Summary of Clinical and Laboratory Data On 17 Cases Treated by Artificial Fever Therapy.

Case	Sex	Age	Duration	No. Attacks	Heart Lesion	W.B.C. Before Treat.	No. of Days	Fever Temp.	Therapy Total Hrs.	W.B.C. After Treat.	1 cc. Blood Before Treat.	Settled After Treat.	Remarks
I.R.	F.	22	5 weeks	1	Systolic Murmur	9,900	2	103-104	5 hrs.	8,800	24 mm. in 52 min.	29 mm. in 120 min.	Absolutely pain free after 1 treatment. BSR. helped tonsillectomy.
M.W.	F.	29	8 weeks	1	Blowing Systolic Murmur	7,600	5	104-105	15 hrs.	6,800	32 mm. in 60 min.	16 mm. in 60 min.	No pain after 1 treatment. BSR. improved.
O.S.	F.	13	1 week	1	Systolic Murmur	8,500	5	104-105	9 hrs.	8,200	62 mm. in 63 min.	12 mm. in 60 min.	Complete relief after 1 treatment.
C.W.	M.	22	4 weeks	2	Mitral Stenosis	14,800	6	104-105	18 hrs.	8,000	27 mm. in 63 min.	9 mm. in 60 min.	Some pain relief. BSR. much improved. To work in 6 weeks.
R.MeK.	M.	23	8 weeks	3		9,000	5	103-104	15 hrs.	7,200	52 mm. in 60 min.	51 mm. in 60 min.	Became pain free after 5 treatments. No benefit from tonsillectomy.
M.L.	F.	9	9 weeks	1		7,000	7	104-106	14 hrs.		26 mm. in 60 min.	24 mm. in 60 min.	Slight benefit from tonsillectomy. 2 months later still active.
O.B.	M.	11	5 weeks	1	Systolic Murmur	4,600	9	104-106	27 hrs.	8,600	33 mm. in 60 min.	20 mm. in 60 min.	Chorea practically cleared up. Tonsillectomy done.
C.T.	M.	12	2 weeks	1	Systolic Murmur — Chorea		5	104-105	15 hrs.		25 mm. in 60 min.	8 mm. in 60 min.	No pain after first treatment. 5 months later active — 1 treatment, then inactive in 6 weeks.
K.C.	F.	11	4 mos.	2	Systolic Murmur	7,000	10	103-106	20 hrs.	6,300	32 mm. in 60 min.	10 mm. in 90 min.	Chorea all recovered. Active cardiac disease well. Murmur disappeared.
B.H.	F.	13	8 mos.	2	Presystolic Apical Murmur	7,500	17	105-106	42½ hrs.	9,700			3 months later no pain, no thrill, no murmur, no chorea.
C.G.	F.	8		1	Systolic Murmur	9,100	26	105-106	65 hrs.			3 mm. in 60 min.	Very refractive. No chorea after 26 treatments. Poor risk until after fever. Tonsils out.
F.H.	M.	14	6 weeks	1	Presystolic and Systolic Hypertrophy	5,600	3	105-106	7½ hrs.		49 mm. in 60 min.		After 4 weeks bed rest some improved. Fever followed by marked help, especially BSR. No recurrence of pain.
M.W.	F.	15	6 mos.		Systolic Murmur		9	105-106	22½ hrs.	6,750	8 mm. in 60 min.		Improved slowly on bed rest and salicylates. After fever showed marked improvement. No chorea — heart better.
L.B.	M.	12	3 mos.	1	Presystolic Murmur		7	105-106	17½ hrs.				No chorea after 7 treatments. Heart findings same. Became afebrile — recovered.
E.S.	M.	11	5½ yrs.	1	Presystolic Apical Murmur	7,150	19	104-106	49½ hrs.				Chorea improved. No change in heart findings. General improvement.
D.W.	F.	17	7½ mos.	1	Rapid Pulse Deficit	11,000	12	105-106	30 hrs.	4,750			Chorea gone. Epistaxis also cleared after fever. 19 months later, no recurrence.
M.F.	F.	15	3 days	1	Systolic at Apex	13,100	3	105-106	7½ hrs.	8,350	60 mm. in 60 min.	22 mm. in 60 min.	6 weeks bed rest, afebrile but rapid BSR. and heart murmur louder. After 3 treatments was improved; then had tonsils out.

that they have high diagnostic value. Figure 1 gives the changes in sedimentation rate during and following fever therapy in 20 of the patients. In the rest of the two groups sedimentation rates were not determined. Fifteen out of 20 showed a sharp drop in the sedimentation rate during the short periods of fever therapy.

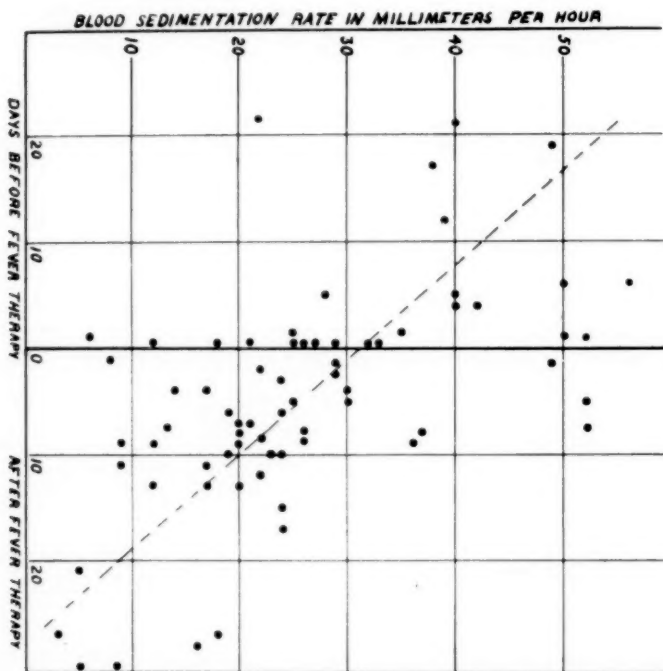


Fig. 1.—Sedimentation rates before and after fever therapy in 20 cases of rheumatic fever. Dashed line is graphic trend of data.

Complete relief of pain can and does occur without any immediate improvement in the sedimentation rate. A fall may occur even in cases in which the tonsils were infected and in all probability related to the rheumatic fever. Following a reduction in sedimentation rate after fever therapy a subsequent tonsillectomy may increase the rate. This was observed in patients M. W. and M. E. F. in which the sedimentation rates dropped from 58 to 17 and from 43 to 22 mm. after fever therapy. Tonsillectomy caused the rates to rise to 44 and 41 mm., respectively, which then subsided. In contrast C. W. had no increase in sedimentation rate following tonsillectomy, due possibly to a continuation of fever therapy up to the time of the operation, after which several more treatments were administered. Re-examination of C. W. six weeks later revealed a weight gain of 10 pounds and a normal sedimentation rate. C. T., who obtained prompt joint relief, did not reach a normal sedimentation rate for some months later. Restudy a year later revealed a history of repeated attacks of otitis media with several nasal operations for sinusitis. It was the patient's conviction that the nose had improved during the period following fever therapy and the otorhinolaryngologist reported the patient free from significant disease. We felt that the nasal disease overlooked at the time that fever therapy was started might have contributed to the delay in reaching a normal sedimentation rate in spite of the patient's definite symptomatic improvement. In several other cases in which physical fever resulted in symptomatic relief

without significant drop in the sedimentation rate, a subsequent tonsillectomy reduced the rate. Except in the case of C. T. we have attempted to remove significant foci of infection. Realizing that removal of focal infection may be followed by exacerbation of activity, at the present time when foci are removed we follow the surgical procedure with several extra heatings. This may have accounted for C. W.'s lack of rise in sedimentation rate after tonsillectomy, in spite of the fact that she had a slight exacerbation of joint pain.

The relation between foci of infection and exacerbation of acute rheumatic fever is a complex one. Fever therapy appears to give joint relief even in the presence of presumed causative foci of infection. Except in the case of C. T. we have attempted to remove such foci and consequently have no opinion as to the duration of relief in the presence of a presumably active focus of infection.

In our entire series there has been a sufficiently large number of cases of rheumatic heart disease to warrant the statement that fever therapy is definitely not contraindicated, but in all probability is of benefit. D. W.² had acute pericarditis which responded promptly to fever although 2½ weeks of bed rest and salicylates resulted in but slight improvement. Another case of pericarditis with effusion (G. L. M.²) responded promptly. These two cases have been free from recurrence of rheumatic fever for two and three years, respectively. D. W., with a pulse of 152 and a deficit of 22, responded promptly. We have heated 11 cases with mitral stenosis and 14 with systolic murmurs of varying degrees. It is our opinion, after close observation, that none have in any way suffered any cardiac damage as a result of fever therapy. Only one has shown subsequent progression of the heart lesion, and those with minimal heart involvement almost without exception show disappearance of the murmurs. The exception was A. H., the first case treated in our department. There has been no recurrence of pain nor active infection, but during the past six months she has had sufficient edema of the lower extremities to necessitate observation and the administration of digitalis. This patient is past 50, has a marked mitral stenosis, and these findings are the results of mechanical defects and lowered cardiac reserve rather than active infection.

After study of these cases over a period of one month to 3½ years, we feel from the clinical improvement and improvement in laboratory tests, that most cases treated with artificial fever therapy terminate their active disease more rapidly than with bed rest and large doses of salicylates. By shortening this period they are liable to suffer less cardiac damage. In other areas where climatic factors are different, or where the incidence of rheumatic fever is higher, or where adequate convalescent homes are available, fever therapy might not be so definitely indicated. The action of fever therapy in rheumatic fever is probably through ill defined constitutional and immunologic factors, in contrast to the thermal death action obtained with the gonococcus and probably *treponema pallidum*.

There are certain cases in which fever therapy would seem contraindicated. Cases of advanced mitral stenosis in which mechanical factors have seriously reduced the cardiac reserve, or those with chronic rheumatic hypertrophy of the heart with the possibility of cardiac thrombi might well result in disaster.

There is much evidence that the method of producing fever as such is not of fundamental importance. Much of Sutton and Dodge's earlier work on chorea and rheumatic carditis was done with typhoid vaccine to produce the fever⁵⁻⁶. Doan, Hargraves and Kester have shown in experimental animals that histologic response in bone marrow and lymphoid apparatus is similar with a variety of fever producing agents, including physical fever⁷.

The Kettering Hypertherm Cabinet using warm conditioned air at temperatures not exceeding 120 to 130 F. and a humidity of 83 to 93 per cent permits excellent control with minimal skin water losses. The design of the cabinet permits close observation of the patient's body and easy access for the intravenous administration of fluids without having to remove the patient from the cabinet. The value of trained personnel in operating such cabinets cannot be over emphasized. The dangers of large doses of sedatives have been recognized by most students of pyretotherapy, and particularly studied by Hartman⁸. All cases are given a trial heating of one to two hours at a temperature of 102-103 F. and after this the heatings are usually continued every other day. Although a number of our patients have been heated to 105-106 F. (measured per rectum), we do not believe that such high temperatures are usually necessary, and in most cases a rise to 103-104 is adequate. When there is failure or a poor response at this temperature, the subsequent treatment is given at 104-105, and the highest at 105-106, which is the fever level where best results are obtained in cases complicated by chorea. The duration of the treatment is usually 2½ to 3 hours, and the number varies according to the symptomatic response, but usually four to six are sufficient. The cases with chorea usually require a larger number of heatings at higher fever levels. If definite relief has not been afforded from rheumatic pain in four to six treatments, except in cases complicated by chorea, we feel that the diagnosis of rheumatic fever is probably erroneous.

Summary *

1. Thirty-one cases of acute rheumatic fever were treated with the Kettering Hypertherm Cabinet for periods of 5 to 65 hours with temperatures of 103-106 F.
2. In the group were 11 cases with mitral stenosis, 14 with systolic murmurs, 1 with acute pericarditis, 1 with pericarditis and effusion, and 1 with acute carditis and a marked pulse deficit.
3. Complete and prompt relief of joint pains and swelling were obtained in almost all cases studied.
4. In no case were we able to determine that the heart lesions were aggravated by fever therapy. The period of subclinical activity was shortened and in the cases with minimal heart involvement the murmurs disappeared. These results cannot be fully ascribed to the effect of fever therapy alone.
5. Symptomatic relief from joint pain has been afforded regardless of the presence of significant foci of infection, but we do not have data on the prolonged effect of fever therapy on such foci since they were subsequently removed. We do not believe that fever therapy is a substitute for the removal of significant foci of infection.
6. Fifteen out of 20 cases showed a sharp drop in the sedimentation rate during the course of or immediately after fever therapy.
7. More time must elapse and larger groups must be observed before the position of fever therapy can be established, but we feel that it is of definite aid in the treatment of acute rheumatic fever.

References

1. Fever Therapy. Abstracts and Discussions of Papers Presented at the First International Conference on Fever Therapy, March, 1937, New York, Paul B. Hoeber, 1937.

* We are indebted to Mr. Charles F. Kettering, Director of General Motors Research Department and to Dr. Walter M. Simpson, Director of the Kettering Institute for Medical Research, Miami Valley Hospital, Dayton, Ohio, for the loan of the Kettering Hypertherm Cabinets used in our studies, and to Dr. F. Ebaugh and Dr. Jack R. Ewalt for the privilege of including the eight cases from the Fever Therapy Department of the University of Colorado.

2. Dunn, F. Lowell, and Simmons, E. E.: Fever Therapy in the Treatment of Acute Rheumatic Fever, *Ann. Int. Med.* 11:1600 (March) 1938.
3. Bland, E. F., and Jones, T. D.: Clinical Observations on the Events Preceding the Appearance of Rheumatic Fever, *J. Clin. Investigation* 14:633 (Sept.) 1935.
4. Dunn, F. Lowell, and Simmons, E. E.: The Treatment of Arthritis, *Nebraska S. M. J.* 23:330 (Sept.) 1938.
5. Sutton, L. P., and Dodge, K. G.: Fever Therapy in Chorea and in Rheumatic Carditis With and Without Chorea, *J. Lab. & Clin. Med.* 21:619 (March) 1936.
6. ———: Follow-up Report of Ninety-nine Children Who Received Fever Therapy for Chorea, *J. Pediat.* 12:490 (April) 1938.
7. Doan, C. A.; Hargraves, M.M., and Kester, L.: Differential Reaction of Bone Marrow, Connective Tissue, and Lymph Nodes to Hyperpyrexia in Fever Therapy, *New York, Paul B. Hoeber*, 1937, p. 40.
8. Hartman, F. W.: Lesions of the Brain Following Artificial Fever Therapy, *J. A. M. A.* 109:2116 (Dec. 25) 1937.

Discussion of Papers by Drs. Kenneth Phillips,[†] Malcolm M. Cook, Milton G. Schmitt*, F. Lowell Dunn, and Eugene E. Simmons

Dr. Robert M. Stecher (Cleveland): Dr. Phillips' paper seems to me to be a curious combination of well known platitudes and unconventional recommendations. He states that "Such a report confined to general management should not be studded with scientific references or discussion of literature already published but should be seasoned with points of practical experience which will be of value to the neophyte, especially he who is starting to foster the project," the project of fever therapy, he means. His paper is poorly designed to guide the neophyte because it is incomplete and because he has settled dogmatically many controversial problems. For the benefit of the neophyte let me express my personal opinion that in spite of press, radio and moving picture publicity which has called fever therapy to the attention of the general public, the method has reached its peak. The one disease for which fever therapy formerly held a unique position of offering the possibility of specific cure in a high percentage of cases is gonorrhea. Sulfanilamide now seems to be effecting satisfactory results in a high percentage of patients with this disease. Not only is it resulting in cures but it has materially diminished the incidence of complications. At the City Hospital the fever department constantly had one to four patients under treatment for gonorrhea. Inasmuch as these patients were under treatment for an average period of less than two weeks, this represented considerable material. Since the advent of sulfanilamide, patients referred for fever therapy have dropped virtually to the vanishing point, and we certainly do not average a patient a month. Fever is still important for the treatment of gonorrhea, but this importance depends very largely upon the few patients who are intolerant to sulfanilamide.

Dr. Phillips is enthusiastic in his recommendation of the electromagnetic induction method of producing artificial fever. This method is undoubtedly satisfactory, and it enjoys the hearty recommen-

dation of many of its users. Some of the arguments advanced in its favor, however, seem illogical to me. Dr. Phillips mentions the fact that the normal temperature of the skin is several degrees below that of the internal body. I cannot follow his argument, however, when he intimates that raising the skin temperature to that of the body or above is a great disadvantage. I know of no evidence to support his statement, "Under this normal mechanism the skin remains cool, free to eliminate and carry its normal excretory function." In fact, the usual argument of supporters of the electromagnetic induction method over the use of plain air-conditioned cabinets is that air-conditioning increases the excretion, particularly of sweat and chloride more than does electromagnetic induction. Allow me to point out that satisfactory fever treatments are being given by various methods employing several different principles. It seems to me the method used is of less importance than the experience, care and general clinical judgment applied to the different methods. We agree heartily with Dr. Phillips that the patient should be prepared by proper nutrition, hydration and attention to salt intake before and even during the treatment, as becomes necessary. We agree heartily that the patient should be supervised properly during the treatment by competent and experienced technicians, and we agree also that the contraindications for fever therapy are not so strict as we considered them to be several years ago. Under this heading Dr. Phillips, however, has made a careless statement which I am sure he does not mean literally. He states, "For example, where once we shunned hypertension, nephritis, cardiac disease and young children, we now score some of our best results in just these patients." He does not mean that these diseases are satisfactorily treated by fever therapy but what he does mean is that patients with these diseases in their milder forms tolerate fever treatment when it is indicated. It seems to me that this paper would have been improved if the author had avoided overemphasis and undue dramatization.

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† Published in August, 1939 issue of ARCHIVES.

Although the beneficial effects of artificial fever in acute rheumatic fever may not be susceptible to proof according to the strictest statistical criteria, the results reported in this paper as well as those of other workers certainly substantiate that it is an effective method. The prompt relief of arthritis, the slowing of tachycardia and the decreased incidence of subsequent attacks all show that artificial fever therapy is useful. It must be borne in mind, however, that acute rheumatic fever is essentially a self-limited disease and, even without treatment subsides spontaneously. On viewing the charts presented this morning I am struck with the fact that patients received from two to twenty-six treatments and were relieved of symptoms with from five to sixty-five hours of fever. Only a small proportion of the patients received a large number of fever treatments over a prolonged period but in these the suspicion may be justified that they were treated until the disease subsided spontaneously. It is important to bear in mind that mild cardiac involvement by rheumatic fever is not a contraindication to artificial fever. Tachycardia subsides, simple systolic murmurs decrease in intensity or disappear entirely with fever therapy, and even definitely established mitral stenosis in the absence of cardiac failure does not seem to be a contraindication. Most physicians are hesitant about treating patients with definite carditis by such strenuous methods, but it is perfectly possible that as experience increases, we may find such patients derive benefits out of all proportion to our apprehension. This may become wholly justified by experience and may offer an extremely important method of therapy. Let me congratulate the authors upon the statistical form in which they have presented their findings and upon the conservative conclusions to which they have arrived. One serious fault of the work is the absence of an adequate control series. Inasmuch as it has taken them several years to accumulate a series of twenty-five treated cases, it becomes apparent how difficult an adequate control series would have been.

It seems unfortunate that Dr. Schmitt has not given us a more accurate definition of what he considers a fever treatment. It makes a great deal of difference in the selection of the patient, the handling of the treatment, the complications to be expected and the dangers to be avoided whether we are discussing a fever treatment of short duration, say two or three hours, and at a relatively low fever between 103 and 104 F., or we are thinking of a treatment for gonorrhea where a temperature approaching 107 F. may be maintained for six to ten hours. Precautions which may be desirable for a severe treatment may not be necessary for milder treatments. Although the burden imposed upon the heart by fever treatment has been stressed many times, it seems to me that the danger is more apparent than real. It is true that high pulse rates

occur and may necessitate the termination of a treatment, but I have yet to see a patient in whom I thought the heart failed or the cardiac muscle was damaged by fever therapy. Shock does occur associated with peripheral vascular dilatation and the fall of blood pressure, but this condition is not due to weakened heart action. For these reasons it would seem that routine electrocardiograms on fever patients are neither necessary nor desirable. A proper history concerning cardiac function and ordinary physical examination revealing gross abnormalities of cardiac size and valvular defects would seem sufficient in routine cases, reserving electrocardiographic investigation for borderline or doubtful patients or those beyond middle age. Routine blood chemical analyses also seem to be unnecessary. The finding of a significantly elevated non-protein nitrogen in the blood of a patient who is otherwise quite well and without symptoms suggestive of kidney damage or high blood pressure must be extremely rare. The same can be said of low blood sugar levels ranging from 60 to 80 milligrams per one-hundred cubic centimeter. In the beginning of our experience with fever therapy numerous determinations of blood sugar levels were made upon fever patients before and after treatment. We were greatly surprised to find that the blood sugar level even after severe and prolonged treatment was at least as high and more frequently was considerably higher than the pre-treatment level. This was done in the days when treatments were given to patients on an empty stomach. The hazard of hypoglycemic shock is less than it was then in view of the fact that patients usually eat breakfast before treatments. I can truthfully say that we have not recognized hypoglycemic shock in patients receiving fever therapy. The recommendation for pre-treatment preparation with a mixture of sodium chloride, glucose and gelatin is an interesting one. I have had no experience with it but I wonder what advantage such a mixture has over an egg-nogg or chocolate malted milk. It seems to me to be hardly necessary in well nourished and well fed patients who are to have standard fever treatments. Dr. Schmitt's paper is sound, his recommendations are logical and certainly can do no harm. It is possible, however, that they are not necessary for routine patients, and they tend to make fever treatments more of a ritual than need be.

Dr. Cook has given us a brief analysis of the relationship between heat production and heat loss in the induction of fever by physical means. His experience is a strong recommendation for air-conditioned cabinet methods. His ability to produce and maintain satisfactory fever in a one-hundred per cent humidity with cabinet temperatures as low as 115 F. is highly significant. This minimizes almost to the vanishing point the difference between skin and environmental temperatures, the factor which has been considered of great

importance in contributing to the dehydration of fever patients. Furthermore, the atmospheric conditions in his cabinet differ only slightly from those described by the proponents of electromagnetic induction of fever. Dr. Cook accomplishes the same result and has eliminated an expensive and complicated part of the mechanism. He has answered the objections of workers with electromagnetic induction, and his results are entirely satisfactory. The routine treatment charts which he has presented indicate a satisfactory application of his procedure. The desired fever was obtained within a reasonably short time, the proper elevation was maintained without difficulty and the pulse rates seem to me will compare favorably with treatments given by any method now in general use.

Dr. William K. Ishmael (Oklahoma City): For the artificial production of fever Dr. Phillips chooses electromagnetic induction on the premises that the electrolytic concentration of the body fluids is around 0.85 per cent and the body tissues are at some lower level. As electromagnetic induction probably has the greatest heating effect on physiologic concentration of 0.85 per cent, this method is selected over those which heat the lower concentrations more rapidly. Remembering an incident where a child's body was almost completely covered by a tar dermament and his temperature promptly rose to 107 F. I doubt if the body needs but little more than its own energy to generate a fever if the heat loss is properly controlled. It would be more practical to pay greater attention to heat loss and less to the artificial introduction of heat, whether it be by "roasting the patient's skin" or "boiling his blood and tissue fluids".

As for the future of fever therapy I doubt if it will ever be more useful than it is now and for what it is used. It may be that the physiologic or similar effects can be obtained in some other fashion. The methods of giving artificial fever have come a long way and I think that we are wasting effort in differing over the present technics. These evolutionary changes have demonstrated again that from the most scientific planning down to armchair philosophy, that great laboratory of clinical application must be satisfied before the final word is spoken. Dr. Phillips' opinions are the result of the supervision of some 16,000 fever treatments and to me, this is significant.

Dr. Cook has given us probably one of the greatest advances we have had in fever therapy technic for some time. By applying the old principle of the use of latent heat of condensation he has maintained temperature levels without employing any form of radiant or electrical heat energy, thereby eliminating any expensive energizing mechanism. Also by the application of this principle he has eliminated from our equipment the annoying humidistat, and by maintaining the humidity at a constant of 100 per cent he has obviated the

wet bulb thermometer and is able to use the more reliable dry bulb type of thermostat. It appears that with an immersion type vaporizer, he can maintain very accurate cabinet temperatures and humidity. I am of opinion that our future fever cabinets will be designed more in this fashion with possible extra precautions in regard to the conditions surrounding the patient's head and face and the air that he breathes.

Dr. Walter M. Solomon (Cleveland): Dr. Phillips' paper is to be commended because it warns us against the promiscuous use of fever therapy and points out the dangers and complications. He has been in this field for many years. His advice and suggestions as to the preparation of the patient and care during treatment have been the results of a vast experience and may serve as a guide to those who more recently have taken up this work.

In Dr. Schmitt's paper, the preliminary preparation of the patient to prevent chloride loss and dehydration is rational and a means of overcoming this serious factor. It would be interesting to compare his figures of the chloride and acid-base balance in the blood with his method and with the procedures where saline is given during treatment.

The danger of hypoglycemic shock may be more apparent than real. Recently at City Hospital in treating three diabetic patients blood sugar determinations were made. In two cases the blood sugar was between 200 and 250 milligrams before, during and after the treatments. In one diabetic patient receiving protamine insulin and who was being treated with fever for ulcerative colitis, the fasting specimen showed 338 milligrams. When the fever reached 103 F. the blood sugar was 259. After two hours of fever the blood sugar was 55 milligrams and by the next morning it was back to 392 milligrams. All three patients were comfortable and showed no evidence of shock.

I also agree with Dr. Schmitt that sedation is helpful in controlling the discomfort of the patient. After trying many drugs, morphine and pantopon are still the most satisfactory at City Hospital. Of equal importance is the resourcefulness of the technician to whom little enough credit has been given. To demonstrate the efficiency of our technicians and the success of our present methods it might be well to mention that during the past year at City Hospital approximately 800 fever treatments have been given, and only one treatment was discontinued because the patient would not tolerate this type of therapy.

There is an effort in both Dr. Phillips' and Dr. Schmitt's papers to overemphasize the advantages of electromagnetic induction as a means of producing fever. It is obvious that the purpose of any apparatus is to produce the fever in the patient with the greatest safety and with the least discomfort and at the same time be operated economically and conveniently. That the

electromagnetic inductive method is superior to all other methods in any of these principles has yet to be proved. The clinical results in other institutions where so-called external heating is employed compare with those from so-called internal heating institutions, and it is certain that the mortality is not higher or that the patients are more uncomfortable.

The value of fever therapy for acute rheumatic fever can not be determined for many years. First, there is the difficulty, as Drs. Dunn and Simmons relate, in definitely diagnosing the condition as acute rheumatic fever. It has been shown that acute infectious arthritis of the non-specific type can be cured or greatly improved with fever, and secondly, the test of its worth will depend not so much on the relief of the joint symptoms but on its effect on the heart. If fever can be shown to ameliorate the cardiac complications of rheumatic fever and thus add years to the life of these patients, its value will be tremendous.

Dr. O. Leonard Huddleston (Denver): We have been interested in the study of cardiac activity during hyperpyrexia. In order to gain some information concerning this problem we have employed the use of polygrams and electrocardiograms. The electrocardiograms were recorded by means of a string galvanometer. The polygrams were recorded simultaneously on the same record by means of Frank capsules which reflected light beams into the electrocardiograph camera, thus enabling one to photograph the pulse tracings on the electrocardiogram. Analysis of the sphygmograms recorded from the subclavian or lower carotid artery and phlebograms recorded from the subclavian or jugular vein enables one to differentiate various components of the cardiac cycle which occur during the emptying and filling phases. The waves of the electrocardiogram serve mainly in the capacity of standard reference points, to which the various components of sphygmograms and polygrams may be referred for identification. The general procedure we employed during the course of our experiments was as follows: (a) control electrocardiograms of leads I, II and III, and (b) control polygrams of the jugular vein, subclavian artery, lower carotid, upper carotid, radial artery and apex beat were recorded in groups of two simultaneously with lead II of the electrocardiogram, utilizing the combination of electrocardiogram, sphygmogram and phlebogram.

After securing the control records the subject was placed in the fever cabinet and artificial fever started. A series of 13 subjects was used in the study. Pulse tracings from the jugular vein and subclavian artery, from the lower carotid and jugular vein, from the upper carotid and jugular vein each combined with lead II of the electrocardiogram were recorded at approximately each degree Fahrenheit during the elevation of body temperature, up to and including 106 F. Analysis of the results of the pulse tracings thus recorded indicate the following general conclusions:

1. The electrocardiograms show (a) disappearance of the normal sinus arrhythmia and the cardiac rhythm becomes remarkably regular; (b) the conduction time (P-R interval) is shortened 0.02 to 0.06 seconds during the elevation of body temperature, being shortest at 105.0 F. The conduction rate concomitantly slows to its former conduction velocity as the temperature falls.

2. The sphygmograms show considerable alteration in size, shape and composition. They become more triangular in shape and are often definitely "spiked." The dicrotic notch becomes lowered on the catarcotic limb, often descending considerably below the base line. The dicrotic wave is frequently enlarged and prolonged. Additional anacrotic waves appear and there are frequently several predicrotic and postdicrotic waves of frequencies ranging from 20 to 40 cycles per second.

3. The total filling time of the ventricles is rapidly reduced to 40 per cent of the normal filling time by the time the temperature is elevated to 100.5 F. and reaches its lowest level (28 per cent of the normal total filling time) at 103.5 F. Following this the filling time slightly increases in duration so that the filling time again becomes greater than that of the emptying time.

4. The constituent phases of ventricular filling are rapidly and more or less progressively diminished in duration as the body temperature is elevated, reaching their lowest respective levels at 102.5 to 103.5 F. Their duration, except for the phase of diastasis, increases again above this temperature level. The phase of diastasis is often completely abolished at temperatures higher than 103.0 F. The arterial systole and diastole curves practically parallel the isometric relaxation curve, suggesting the presence of similar functional changes in the behavior of the atrial musculature to those which presumably occur in the ventricles during isometric relaxation.

5. The emptying time of the ventricles is progressively shortened from a normal duration of 0.34 to 0.18 sec. (53 per cent of the normal emptying time). The reduced ejection phase is slightly more shortened than the maximum ejection phase; their curves, however, are nearly parallel.

6. The rapid filling and slow filling phases of the ventricles show a marked reduction in the duration of the filling time at temperatures ranging between 102.5 and 103.5 F. These filling curves suggest that both the distressing symptoms one observes and the subjective discomfort frequently experienced by patients at this range of hyperthermy during the induction of artificial hyperpyrexia might be accounted for by an inadequate filling of the heart because of insufficient duration of the filling time. Compensation may be accounted for not only by an increase in the efficiency of the emptying of the ventricles but also by a more adequate ventricular filling brought about by an increase in the duration of the filling time.

7. The phlebograms show considerable variation in size, shape and contour. The 'C' wave becomes accentuated, often converting an atrial type of phlebogram into an impact type. The vibratory waves of the second heart sound become exaggerated. The 'V' wave frequently becomes quite inconspicuous. Often there is no line of demarcation between slow and rapid filling of the ventricles. The 'A' wave which is indicative of atrial activity usually becomes relatively increased in size after the temperature is elevated above 103.5 F. The relative increase in size of the 'A' wave, together with the increase in the duration of atrial systole and diastole suggest that the atria may become increasingly more important in filling the ventricles when the heart rate is rapid and may serve as one of the important compensatory mechanisms in relieving the distress during and following the induction stage of artificial hyperpyrexia.

With regard to the various methods which are employed to administer artificial fever therapy, we have heard considerable discussion this morning. It is gratifying to hear that various investigators emphasize the importance of utilizing the principles of low external temperature and high relative humidity. We now realize that practically all the workers are in agreement that the principle of insulation is of extreme importance in maintaining a high body temperature and that measures taken to prevent the loss of heat from the body are probably more important than those employed to generate body heat. It seems evident that practically all investigators are utilizing the same fundamental principles in maintaining an elevated body temperature, i.e., a relatively low external temperature and a high relative humidity. The essential difference in the methods as they exist today appears to be limited almost entirely to the matter of inducing the artificial fever. We have heard sufficient controversy already so that additional criticism of the present methods seems almost unwarranted. However, it is my belief that the method employing the latent heat of vaporization introduced by Dr. Cook is a most commendable procedure and one which is based upon sound, physiologic principles. From a theoretical point of view, I believe that this method will in time supplant many of those which are in vogue at present since it has so many things in its favor, not only from the point of view of simplicity, utility, high humidity, low cabinet temperature, and the like, but also from the standpoint of economy.

I have been very much interested in the development of various methods of artificial hyperpyrexia since the earlier methods in my opinion did not appear to employ sound physiologic principles. During the course of discussion in our physiology seminars at our institution we decided years ago that the ideal method of inducing and maintaining artificial hyperpyrexia should make use of a high rela-

tive humidity and a low environmental temperature and that various principles of insulation which minimize heat loss should be employed. We believed, therefore, that principles which provided maximum insulation would be advantageous to use both experimentally and clinically. In discussing our views with certain clinicians regarding hyperpyrexia our opinions were discounted about 99 per cent and abandoned with a certain amount of ridicule. Needless to say it is somewhat gratifying to see the same plans now coming into use which we advocated on theoretical grounds several years ago.

Therefore I wish to take this opportunity to make a plea which seems to me to possess considerable merit, that of closer cooperation between the physiologist and the clinician. It is my belief that the majority of clinicians are in the habit of regarding the physiologist as purely a laboratory man. Furthermore, I believe that much too often he is regarded as an impractical theorist. I am convinced that clinicians might utilize some of the theory and laboratory information of the physiologist with profit should they take the trouble to bring him out of the laboratory for consultation and advice on some of the numerous practical clinical problems. The above mentioned example regarding the development of the method of administering artificial hyperpyrexia, I believe amply illustrates my point and justifies my contention. In the future let us work for closer cooperation and I am sure we will be rewarded with mutual benefit.

Dr. K. Phillips (closing): Dr. Stecher is evidently viewing the progress of fever therapy from the standpoint of gonorrhea. The clinical conditions which are now responding favorably to fever therapy are too numerous to segregate in this discussion, but they are quite definite and are on the increase. In contrast to their decrease in demand for fever therapy, we find it necessary to operate three apparatus almost constantly.

Regardless of controversy, the physiologic mechanism of heat control in the normal is balanced so that the skin temperature is below that of the internal body. I fail to agree with the discussors who state that there is no evidence to support the opinion that this mechanism should be maintained. Phillips and Shikany in 1934 demonstrated the difference between external and penetrating heat upon the heart rate and circulatory system. This has been repeatedly confirmed. Neymann, Osborne and Holmquest demonstrated a decrease (not an increase) in sweat with external heat. Gibson, Kopp and Evans found a difference in dehydration and blood volume when the two methods were compared. Pijoan has found a difference in the acid-base, balance, and Litterer and Phillips have demonstrated a marked difference in the crystalloids as excreted by the skin. It would, therefore, appear that the opinion that the method of fever produc-

tion is of little importance will soon be accepted as erroneous.

Emphasis on prevention of heat loss as brought out by Dr. Ishmael appeals to me very much. I wonder if as yet comparison of the subcutaneous and internal body temperatures has been determined?

I saw a demonstration of Dr. Schmitt's experiment with beef steak, and to me it is most interesting and significant. With their atomized water vapor they can periodically cool the skin and the beneficial results to the pulse rate and comfort to the patient are undeniable. This method also will be taken to task by the external heat advocates, as well as those who assert that the agency makes little difference. Nevertheless, as fever therapy grows, and I reiterate that it is growing, these differences will settle themselves by trial, error and clinical experience.

Finally a word about the charge that I have dramatized the problem. If the gravity of the cases needing such heroic treatment as artificial fever is taken into account and the fact is acknowledged that this very method has already restored countless humans to lives of usefulness, then I am pleased to accept the dramatic aspect. Since the science of medicine is not static, any progress carries in itself a dramatic element. Dr. Stecher read into the record quotations of my address with the innuendo that they imply conditions which any fair-minded person can readily interpret in their true meaning.

Dr. Milton G. Schmitt (closing): In response to Dr. Stecher's inquiry as to my accurate definition of what I consider a fever treatment I may say that our usual procedure is an eight-hour fever curve with a sustained fever level for $5\frac{1}{2}$ to 6 hours. We give temperatures ranging from 103 to 107 F. rectally as indicated by the condition to be treated. Our work is all done on private pay patients and in most cases I have an added accountability to a referring physician. Dr. Stecher states that a routine electrocardiogram is neither necessary nor desirable; also that the chemical analysis of the blood seems unnecessary. It is my opinion that all precautions which can be taken are desirable in such a major procedure as fever therapy, especially in the higher temperature ranges. Last year I was forced to deny fever treatments to seven patients on the basis of the findings of a partial heart block on the electrocardiogram. In no case was the referring physician aware of any interference in the conduction timing mechanism in the heart.

I submit the fact that there are still some unexplained deaths which have occurred during fever therapy. I suggest that some of these may have been due to a failure of the timing mechanism in the heart in which case the findings at the autopsy would be wholly negative.

Dr. Huddleston's graphic study of the normal heart shows that there is a relative decompensation after hours of fever. This work suggests to me that an actual failure in cases of partial heart block may be very imminent. I suggest also that some of the unexplained deaths might be due to hypoglycemia and unless blood is drawn for examination immediately at the moment of death, the postmortem findings would be nil.

Dr. McGuinness referred to the frequent use of scopolamine. I believe that this drug should be used with a great deal of caution. In my practice I reserve its use for those patients who are inadequately managed by the usual methods. In such cases I give scopolamine gr. 1/200 with pantopon gr 1/6 hypodermically. This amount does slow up the rate of perspiration but does not stop it entirely.

Dr. McGuinness also stated that fever treatments are avoided during menstruation. In our experience this is unnecessary, we have treated many cases during menstruation without any untoward effects.

Dr. Schmidt stated that "there is no scientific proof of the disadvantage of external heat." I regard the work of Gibson and Kopp as scientific and they are among the best workers in our country. I quote from their recent article "The Physiology of Fever," published in the *Journal of Clinical Investigation*, May, 1938. "Gross water loss is determined principally by the temperature and to some extent by the relative humidity of the patient's immediate environment. The water loss was greatest in those cases in whom the differential temperature between the patient's body and his environment was highest, and least in those cases in whom it was lowest." This would indicate that the use of a high temperature of the environmental air is not physiologically sound.

Dr. Schmidt also minimized the importance of the high pulse rates which occur when external heat is used. I refer again to the exhibit of Dr. Huddleston on the performance of the normal heart during hyperpyrexia. This work definitely indicates that it is important to spare the heart during fever. This is truly scientific proof of one of the disadvantages of the use of external heat for fever therapy.



PRESENT STATUS OF SHORT WAVE DIATHERMY *

RICHARD KOVÁCS, M.D.

NEW YORK

Short wave diathermy has become fully established during the past six years as part of our armamentarium. Simplicity and relative safety of its application have popularized it to an unprecedented degree. In inverse proportion to the expansion of short wave diathermy, the use of conventional or long wave diathermy has decreased and the manufacture of its apparatus has practically ceased. The world-wide interest in the new method has resulted in a large amount of laboratory research and data, and has also produced some confusing claims. It takes more than six years to establish the true value and scope of a therapeutic measure, such as short wave diathermy, which is applicable in a wide range of conditions. While, by this time a fairly definite opinion about its biophysical effects has been reached, on the technical side there still exist a number of problems necessitating controlled studies about its effects as compared to the classic method. The object of this presentation is to discuss some of these problems.

Biophysical Effects

The most striking physical property of oscillations below 30 meters is their ability to pass through electrically conductive as well as poor conductive substances and the consequent heating effect by both conduction and capacity. However, this is not an exclusive characteristic of short wave diathermy. For years it was attained in a degree through an insulating pad when long wave diathermy was applied in the form of autocondensation. With short wave diathermy, passage by dielectric capacity occurs in direct relation to the dielectric constants of tissues and the frequency of oscillation, as shown in table 1.

TABLE 1. — *Equations of Electrical Capacity.*

$R_c = \frac{2Tfc}{1}$		$C = \frac{EF}{4Td}$	
R = Capacity Resistance of the Body		C = Capacity of Electrodes	
f = Frequency in Cycles		E = Dielectric Constant	
c = Capacity of Electrodes		F = Area of Electrodes	
		d = Distance Between Electrodes	
Dielectric Constants			
Muscle	70 to 75	Fat	11 to 13
Liver	70 to 75	Bone	65 to 75
Kidney	85 to 90	Air	1

The combination of conductive and capacitative flow of current through all body tissues is the basis of the theoretical conception of a fairly uniform heating effect by short wave diathermy. On the other hand, while in laboratory experiments with dead tissues so-called selective heating of certain structures could be demonstrated, in actual clinical practice the conditions are different. It is now generally recognized that in the complex structures of the human body, equalization by the circulating blood and conduction to and from adjacent structures excludes the possibility of sustained selective heating of any tissues.

* Read at the Western Sectional Meeting of the American Congress of Physical Therapy, Los Angeles, June 15th, 1939.

The relation of frequency or wavelength to heat effect has been the subject of much experimental and some clinical study. In electrolytic solutions it has been possible to produce maximum heating at a particular frequency which is related to the electrical conductivity and dielectric constant of the solution. However, in live human tissues no particular wavelength or frequency could be consistently shown as of maximum effect. (Coulter and Osborne¹.) The consensus of opinion of most American observers about tissue heating is that differences in the power output of apparatus, the energy delivered to the patient and the technic employed play a more important role than the wavelength per se. The preference expressed by continental observers for the shorter wavelengths (6 to 12 meters) in the treatment of acute inflammatory conditions seems to be based on acceptable clinical evidence and will be discussed later on.

So-called athermal effects have been the subject of some speculation and much controversy. A few investigators claimed that with low output energy of short wave apparatus, all thermal effects could be eliminated and "electrospecific" effects exerted in conditions in which the autonomic or sensory nervous system is affected. The most recent experimental observations (Tomberg,² Hasché³) refute such effects. I gave one of the foreign exponents of the athermic theory an opportunity in my service clinically to substantiate this claim. This eminent neurologist selected and treated his own cases. It developed that the reports of subjective improvement by patients were his chief criteria of effectiveness, but the procedure with a 1-watt output apparatus impressed me more as a form of suggestive therapy. On the other hand, careful clinical observation has shown that with graded thermal dosage ranging from mild to severe, a variety of clinical effects can be accomplished.

Specific bactericidal effects by local short wave applications have likewise been disproved. Any effect on bacteria in the tissues must be regarded as a result of impairment of their vitality by direct heating or the indirect result of increased cell activity and hyperemia in the tissues.

Summing up all evidence available at present, it would appear that tissue heating is the only proved biophysical effect of short wave applications. Hildebrandt⁴ recently investigated pharmacologic effects with short waves, assuming that in addition to a thermal effect on the tissues, chemical processes are also produced. The histamine content of dogs' blood was examined after treating the thorax one-half to one hour with 3.5 meter waves. Specimens of blood were taken at various intervals, showing an immediate increase of several hundred per cent in some, while in others the maximum was reached after two hours. A return to normal value ensued in all gradually in the next few hours. Diathermic tests yielded virtually the same results. Hildebrandt attributes the influence of the histamine content of the blood to the pronounced thermal effect of the short wave current.

Considerations of Technic

The practical advantage claimed for oscillations of very high frequency is ability to pass through dielectric substance which facilitates application without actual contact between the electrode metal and the skin. Thus, the application and retention of electrodes is simplified, parts with bony prominences can be treated and the danger of burns is considerably lessened. There is also offered a choice of two technics, that of condenser field and that of coil field heating, referred to as electromagnetic induction. These new technics, however, also created the following problems:

Spacing of Electrodes in the condenser field is one of the new problems. In phantom experiments it is possible accurately to determine the spacing

for best heating according to the wavelength employed and the depth to be affected. With the longer wavelength, less spacing even to the point of contact is essential, while with shorter wavelength deep heating requires more skin-electrode distance. It is, however, evident that with an increasing electrode distance, a large amount of radiation into space and waste of energy results. Generally speaking, therefore, for deep heating with the shorter wavelengths, apparatus of larger wattage output is necessary to furnish sufficient energy. However, it has been shown by Kowarschik⁵ and others that increase of spacing acts as a virtual enlargement of the electric field and that the same depth effect can be accomplished by increasing the size of the electrodes.

Metal contact electrodes with short wave diathermy seem to offer a definite possibility of eliminating the problem of spacing and to retain the advantage of dosage measurement as in long wave diathermy. During the past year I have carried out a clinical investigation with a 12-meter apparatus so designed by von Lepel that it enables energy transfer with contact electrodes. The principle of such arrangement is the insertion of suitable condensers in the patient's circuit — so as to compensate for the loss of spacing by the use of contact electrodes — and suitable coupling. In my experience, the clinical results are the same or perhaps even better than with air-spaced electrodes. There is no radio interference because all energy is transferred to the patient, and likewise energy radiation from the cords to metallic objects in the vicinity and from one cord to another no longer occur and the danger of overheating the cords and burning of adjacent inflammable objects is obviated. Finally, it is possible to use a milliamperemeter on the patient's circuit for direct measurement of the short wave energy, as in long wave diathermy.

In order to check up on the all-important point of the effectiveness of deep heating with contact electrodes, comparative measurements were undertaken with the co-operation of Dr. William Bierman. These tests were performed with the standard technics of placing electrodes on the anterior surface of the human thigh and measuring the temperature by a thermocouple inserted in depth. Table 2 shows the technic and results with discs of 5 inch diameter at a distance of 7 inches between the nearest edges of both, and air spacing of $1\frac{1}{4}$ inches.

TABLE 2. — *Heating Average With Air-Spaced Discs.*

Average	Temperatures				
	Between Discs				Cutan. Under
	Cutan.	Subcutan.	Intramusc.	Rectal	Lower Disc Upper Disc
Before	92.55	94.08	97.48	99.6	92.1 94.03
After	98.6	103.66	105.91	99.8	100.41 101.3

Average wattage drawn from line 590.

Table 3 shows the technic and results with metal contact electrodes $5\frac{1}{2}$ inches by 8 inches and a spacing between plates of $4\frac{1}{2}$ inches.

These figures indicate that the cutaneous, subcutaneous, and deep muscle temperatures were substantially the same in both methods of application. An average of six tests was performed on three different subjects, a total of six individuals having been used to obtain the twelve readings. These tests seem to prove that with metal contact electrodes connected to a suitably designed apparatus it is possible to obtain the same elevation of deep temperature as with air-spaced electrodes.

TABLE 3. — *Heating Average With Metal Contact Plates.*

Average	Temperatures				
	Between Discs	Subcutan.	Intramusc.	Rectal	Cutan. Under Upper Disc
Before	92.18	95.35	99.25	99.38	90.76
After	98.8	103.1	106.15	99.67	102.2
Average wattage drawn from line 337 watts.					

Coil field heating (electromagnetic induction), consists of winding either a heavy flexible insulated cable around an extremity or facing any part of the body with a coil in the form of a pancake. The current creates a magnetic field and if the apparatus has sufficient power output, conductive substances placed inside the field will be traversed by so-called eddy currents. The method represents a useful addition to high frequency therapy. Its application is not dependent on any particular make of apparatus, for most of the newer short wave machines are now equipped for the inductive cable technic. It has been shown by Pätzold⁶ that several factors influence the heating, such as the length and shape of the coil, the coil capacity and the length of the wave (frequency of the current). American physicists⁷ have shown that wavelengths of 25 to 20 meters cause the best ratio of heat generation. It must be remembered that this heating takes place primarily in the vascular tissues. For this reason the method is particularly useful in general body heating (hyperpyrexia).

Dosage measurement in short wave diathermy is still an unsolved problem.* The milliammeter of a long wave diathermy apparatus which indicates the total amount of energy passing in the patient's circuit gives a fair estimate of dosage, the amount of current related to the electrode area, and allows its repetition at subsequent treatment. In short wave diathermy apparatus the meter needle merely indicates that energy is passing and that at proper tuning between the oscillator circuit and the patient's circuit there is a maximum flow of energy. But only part of this energy is absorbed by the body the other being radiated into space. This "wattless component" (Hemingway⁸) which is not turned into heat, depends on the size and distance of electrodes and is never the same for two treatments unless the conditions are identical. The true heating current therefore is always less than the meter reading. For this reason in practical application of short wave diathermy the only guide of dosage so far has been the heat sensation of the patient. This is, of course, a variable factor and is altogether unreliable in case of any sensory disturbance.

In proceeding with short wave treatments it is necessary to know that as a rule it takes longer for the warmth to be felt than in conventional diathermy. The initial strength of the current must be adjusted in accordance with previous experience and be guided by the patient's sensation. The generally accepted method of grading dosage at present is to keep within the feeling of comfortable skin warmth, according to the acuteness and the site of the pathologic condition. In painful sensory conditions like neuritis and neuralgia and acute inflammatory conditions of the skin and inner organs one may start the treatment at an energy output which is just enough to cause a feeling of comfortable warmth and then decrease it immediately below that sensation, so that the patient has practically no sensation of heat. In deep chronic inflammation, one may vary the energy output from the continued feeling of comfortable warmth to a more intense feeling of heat, just below the grade in which a sensation of burning begins.

* The problem of dosage has been solved by the work of Mittelman,²¹ Mittelman and Kobak,⁹ and Kowarschik.²²

Because of this crude method of dosage estimation on the one hand, and the simplicity and comparative safety of application on the other, inexperienced operators are constantly applying short wave diathermy in a manner of hit or miss. Inefficient treatments result in a waste of the patient's time and health, and thereby distrust in the method. Hence, it is most desirable that means be found to remedy this unsatisfactory situation.

One may get an approximate estimate of dosage in short wave application of spaced electrodes, when observing the milliammeter connected in the plate circuit of the power tubes in a well designed and balanced circuit. It will show a small reading of the current circulating in the tubes, even when no energy is drawn to the patient. The difference between the "no load" reading and the value indicated during treatment can be estimated to an approximation of the output energy, but it must be interpreted according to the size of the treated parts. However, we must take into account the fact that certain types of output circuit constructions have quite high values of ohmic resistance to R. F. currents, and therefore become quite a percentage factor in relation to the ohmic resistance of the anatomical member. In addition certain resonant or "throttle" controls in the patients circuit may form a considerable portion of the total losses in the entire treating structure. Parts of high resistance and small cross section require less energy for a given heat production than those of low resistance and large cross section.

A dose meter which permits the measurement of the power absorbed by the patient should be reliable and as such is a more desirable method. Such an instrument has been constructed by Mittelmann and has been recently described by this physicist and Kobak.⁹ Unfortunately, I have had no opportunity as yet to appreciate its practical working and await the opportunity for doing so.*



Fig. 1. — Milliammeter inserted in patient's circuit for direct reading in short wave diathermy treatment administered with direct contact plates.

With the method of direct contact plates I have been enabled to get a direct meter reading of the energy administered to the patient. It is possible to connect a meter with this method to the patient's outlets, and because there is no energy loss by radiation into space, the meter gives a definite milliamperereading just as in long wave diathermy. In my limited observation the relation of these readings to the electrode size corresponds fairly well to the values tolerated in long wave diathermy, from 75 to 100 milliam-

* The named workers have now used the Mittelmann dosimeter at Rush Medical College of the University of Chicago and also at Mount Sinai Hospital in many cases with highly satisfactory results. — Ed.

peres per square inch of active electrode surface with the electrodes placed equidistant.

Orificial heating with short wave diathermy is also a subject for careful consideration, both from the standpoint of spacing of electrodes and from that of dosage measurement. With metal contact electrodes of long wave diathermy inserted in the vagina, cervix, female urethra or rectum, it is possible to estimate dosage fairly accurately even without a thermometer, by the reading of the millimeter. The skin sensation under the dispersive electrode is also an aid for the experienced, if the same set-up is employed. In short wave diathermy, none of these considerations prevail and the only safe guide is a thermometer inserted into the shaft of the orificial electrode showing that the rise of temperature in its immediate vicinity is within the safe tolerance estimated. The selection of the best type of active electrode, whether insulated or not and the spacing of the dispersive electrode is also quite a problem, as any one having attempted such treatment with the variety of apparatus available will experience. Abroad for vaginal treatments glass enclosed electrodes are used. In this country the generally given advice is to administer orificial treatments with metal electrodes and long wave apparatus or else to use the induction coil technic. It is doubtful, however, whether heating the soft tissues in toto from the skin inward will accomplish the same result. I have found that with the short wave apparatus described (Lepel), it was satisfactory to employ metal contact electrodes. It also enables the use of the milliamperemeter to estimate dosage and does away with the experimentation of spacing.

Clinical Uses

It is an ever recurring experience with any spectacular new therapeutic agent, that it is greeted with exuberant enthusiasm by some and with marked skepticism by others. Short wave diathermy is no exception. Some of its early heraldings published in medical journals of repute read like this: "It is no exaggeration to call short wave diathermy the greatest discovery of physical medicine since the work of Roentgen," or "Every normal tissue cell has a radio frequency of its own, and by application of short waves of proper frequency, any abnormal tissue may be restored to function." Even Schliephake,¹⁰ with whose name the introduction of this agent is coupled, enumerated in his early writings uses for short wave diathermy along the entire realm of pathology. This is explainable by the fact that his name never appeared in the physical therapy literature before and he was evidently unfamiliar with the results of the time-proven simpler physical measures in conditions for which he advocated short wave diathermy seemingly as a new specific. Sensing the whirlwind he reaped he has become much more conservative in recent writings and warns against the giving of short wave therapy by inexperienced persons. He states that "sufficient experience can only be obtained in an institute in which short wave therapy has been practiced for years by experienced physicians."

Kobak¹¹ came near to the more conservative estimate of the scope of short wave diathermy when he stated two years ago that "in spite of the therapeutic superiority of short wave over conventional diathermy, its field is limited to the management of inflammatory, suppurative and degenerative processes and to the alleviation of algias." A recent article of the Council on Physical Therapy¹² states: "Clinical observations, however, have not indicated that the penetration heat induced by short wave diathermy presents advantages not obtained by conventional diathermy" and enumerates indications and contraindications the same as those of long wave diathermy. In a paper read by Kovács¹³ before the Sixth International Congress of

Physical Medicine at London in 1936, he stated "I do not think that short wave therapy will essentially change the treatment of any condition in which diathermy has been applied heretofore. In due time we will undoubtedly learn under what conditions the newer form of treatment is preferable to the older one."

The matter still seems to rest at that point. Only a few investigations have been published, so that attempts to draw a comparison between the two methods and are not very conclusive. A statistical survey of a group of some hundred cases of traumatic, gynecologic and arthritic patients in my clinic, one-half treated by short wave diathermy, the other by the older method, showed about the same average in clinical results and number of treatments. Delherm and Fischgold,¹⁴ of Paris, likewise reported that in the majority of conditions similar results are accomplished by the two methods. In gynecologic conditions there are several reports (Kovesligethy-Buben,¹⁵ Watters,¹⁶ Otto¹⁷) stating as an advantage of short waves their applicability and efficiency in acute cases, whereas long wave diathermy is only indicated in chronic cases. The difficulty is, of course, that there are no means available to compare exact doses. There can be no doubt that mild heating, no matter from what source, is tolerated and beneficial in most cases of acute inflammation.

Purulent infections of the skin, furuncles, carbuncles, paronychia and suppurative conditions of inner organs, notably lung abscesses, are enumerated by Schliephake and his followers as the conditions in which treatment with wavelengths of six to twelve meters is almost specific. Reports from many competent clinicians corroborate that in purulent skin conditions the relief from pain is usually striking after one or two short wave treatments, and that under a series of treatments resolution and healing progresses satisfactorily. Whether these effects are of a specific nature seems quite questionable. The late Dr. Cumberbatch¹⁸ reported that with long wave diathermy applied by direct contact plates he has achieved similar results to those of short waves. Kovacs¹⁹ has for years found that exposure to luminous heat of mild strength, repeated several times a day, gives very marked relief of pain in these skin infections and also leads to satisfactory resolution in about the same length of time. Hence the final word will only be said when a large number of these cases will have been treated by comparative methods and the results of such a controlled study are published.

Schliephake's favorable reports in the treatment of purulent chest conditions were corroborated as well as denied by some clinicians (Brugsch and Pratt²⁰); therefore this question must be considered as still pending judgment.

In conclusion, I wish to emphasize that it is manifestly impossible to cover within the compass of a brief paper all pertinent aspects of such a vast and new subject as short wave diathermy. My chief aim has been to point out at least a number of the practical questions of present interest.

Summary

1. Short wave diathermy is a convenient method for deep tissue heating, which is comparatively safer than long wave diathermy. Its principal drawback is that dosage estimation is at present entirely based on the heat sensation of the patient.
2. A new technic with contact electrodes is described permitting the use of a milliammeter in the treatment circuit.
3. The clinical range of applicability corresponds closely to that of the older method and includes subacute and chronic inflammatory conditions of deeper tissues and organs. Reports on specific curative effects on skin infec-

tions and acute inflammations of inner organs need further corroboration by extended clinical controls.

4. Short wave diathermy is only one of many important physical measures. Exaggerated claims for its curative powers and the comparative simplicity of technic have served as an incentive for its use by the inexperienced to the exclusion of other methods of equal importance. Combined with the crude method of dosage control this has resulted in much inefficient and unsatisfactory treatment.

2 East 88th Street.

References

1. Coulter, J. S., and Osborne, S. L.: Wavelengths in the Heating of Human Tissues by Short Wave Diathermy, *J. A. M. A.* **110**:639 (Feb. 26) 1938.
2. Tomberg, Victor: Athermic Short Wave Effects, Athermic Therapy, *Strahlentherapie* **59**:373 (June 20) 1937.
3. Hasché, E. Athermic Effects of Short Waves, *Münch. med. Wchnschr.* **85**:1033 (July 8) 1938.
4. Hildebrandt, F.: Foreign Letters, *J. A. M. A.* **112**:1274 (April 1) 1939.
5. Kowarschik, Josef: Deep Action of Short Waves, *Wien. klin. Wchnschr.* **50**:1649, 1937.
6. Pätzold, J.: Short Wave Therapy as a Superior Form of Deep Heat Therapy, *Brit. J. Phys. Med.* **11**:27, 1936.
7. Holmquest, H. J., and Osborne, S. L.: Heating of Electrolytes by High Frequency Currents, Presented before the Am. Cong. Phys. Therap., Chicago, September, 1933.
8. Hemingway, Allan: Physical and Biological Aspects of Short Wave Diathermy, *Arch. Phys. Therap.* **20**:24 (Jan.) 1939.
9. Mittelmann, Eugen, and Kobak, Disraeli: Dosage Measurement in Short Wave Diathermy, *Arch. Phys. Therap.* **19**:725 (Dec.) 1938.
10. Schliephake, Erwin: Accidents in Short Wave Treatment, *Röntgenpraxis* **10**:120 (Feb.) 1938.
11. Kobak, Disraeli: Clinical Aspects of Short Wave Diathermy, *Arch. Phys. Therap.* **18**:396 (July) 1937.
12. Council on Physical Therapy: Medical Diathermy, *J. A. M. A.* **112**:2046 (May 20) 1939.
13. Kovács, Richard: Clinical Comparison between Diathermy and Short Wave Diathermy, *Arch. Phys. Therap.* **17**:432 (July) 1936.
14. Delherm, L., and Fischgold, H.: Physiotherapy of Pain: General Considerations, *J. de radiol. et d'électrol.* **21**:503 (Nov.) 1937.
15. von Kovesligethy-Buben, Ivan: Short Wave Treatment in Gynecology, *Strahlentherapie* **60**:541 (Dec. 18) 1937.
16. Watters, B. D. H.: Output of Short Wave Therapy Machine, *Brit. J. Phys. Med.* **1**:228 (July) 1938.
17. Otto, J.: Value of Short Wave Therapy of Inflammation of the Small Pelvis, *Arch. f. Gynäk.* **163**:633, 1937.
18. Cumberbatch, Elkin P.: Diathermy, 3rd ed., Baltimore, William Wood & Co., 1937, p. 335.
19. Kovács, Richard: Electrotherapy and Light Therapy, 3rd ed., Philadelphia, Lea & Febiger, 1938, p. 669.
20. Brugsch, H. G., and Pratt, J. H.: Short Wave Diathermy in Treatment of Lung Abscess, *J. A. M. A.* **112**:2114 (May 27) 1939.
21. Mittelmann, E.: Dosimetry in Short Wave Dosage, *Arch. Phys. Therap.* **18**: 613 (Sept.) 1937.
22. Kowarschik, J.: The Measurement of Dosage in Short Wave Therapy, *Arch. Phys. Therap.* **20**:208 (April) 1939.



OBSERVATIONS ON RADIOTHERAPY FROM THE GENERAL SURGEON *

DON D. BOWERS, M.D.

INDIANAPOLIS

A heavy responsibility is assumed in selecting a method of treatment for any lesion suspected of being or known to be cancer. The best measures to obtain the desired end should be selected at once, since early and proper management is most essential. Differences of opinion in individual cases are inevitable, yet in a general way many important facts are apparent. There has been a gradual accumulation of knowledge and experience, valuable rules of procedure and working rules for diagnosis and treatment. These should be familiar to the surgeon and radiotherapist engaged in cancer therapy.

The greatest need in oncology is cooperation between the pathologist, radiologist and surgeon. The surgeon must consider irradiation not as a rival of, but as a potent adjunct to operation. He should know the theoretical and practical aspects of roentgen and radium therapy and the advantages and limitations of these as compared with his specialty. Advances in radiology and widespread publicity have in many localities tended to create an impression that cancer is the disease and roentgen or radium therapy the cure. Overenthusiasm of laymen and physicians has often resulted in unfavorable consequences. The radiologist should be sufficiently familiar with surgical procedures properly to evaluate them as well as his own methods. But the surgeon and radiologist should have knowledge of the surgical pathology and pathologic histology of neoplastic diseases and should cooperate with the pathologist. Upon the pathologist falls the burden of determining the type of lesion, its probable grade of malignancy and its inherent radiosensitivity.

Diagnosis and Prognosis

The probable response to treatment by irradiation or surgery alone or both combined cannot be estimated without thorough study of the clinical and microscopic features of the disease. The preliminary essential in determining treatment is an accurate diagnosis, which is also the basis for estimating the prognosis. An accurate diagnosis reveals the probable clinical course of the disease which should be thoroughly familiar to those concerned in its management. Then such events as might lead to failure may be anticipated. An added incentive is the fact that one's skill is often evaluated more by his prognostic ability than his therapeutic successes.

The most valuable single diagnostic aid in cancer is the microscope. Histologic study is of first importance in determining treatment and prognosis. Biopsy should be performed as a preliminary to or during the management of every lesion, and should be repeated in the future as a follow-up guide. Properly conducted biopsy is without danger and furnishes invaluable information relative to the type of lesion, its grade of malignancy, stage of evolution, probable invasiveness and radiosensitivity. The accuracy of clinical diagnosis alone cannot approach that combined with histologic study. Furthermore, accurate management should be a matter of pride and

* Read at the Seventeenth Annual Session of the American Congress of Physical Therapy, Chicago, September 13, 1938.

reports of treatment results are of no scientific value without microscopic evidence.

When possible specimens for biopsy should be obtained electrosurgically. It has obvious advantages. Hemostasis and protection against dissemination of cancer cells and infection is secured. With proper technic adequate specimens are obtained. Furthermore, in localized accessible lesions one can excise the entire neoplasm for biopsy.¹ After such excision, sections help to ascertain whether every portion of the active lesion has been removed, an advantage to both the patient and surgeon. If removal is incomplete further treatment may be instituted immediately.

During the past few years there has developed a tendency to neglect the clinical history and physical examination. Both may reveal data of prime importance for differential diagnosis and outlining treatment. Knowledge of the histologic structure of a lesion is the greatest single diagnostic aid, yet the most experienced physician cannot outline treatment solely by the information gained from a microscopic section. The most skilled pathologist cannot predict the course of events by the study of a slide.

The history is valuable for diagnosis and of increasing value in studying a group of cases for data on which to base working rules for both diagnosis and treatment. General physical examination is most essential in determining the origin, nature and extent of the disease and the general condition of the patient. Supplementary laboratory, x-ray and special studies likely to prove fruitful should not be neglected, keeping in mind the recent diagnostic aids.

The location of a tumor, its point of origin, relationship to surroundings, proximity to vital structures and character of its blood supply and lymphatic drainage should be determined.

A protracted course bespeaks benignity. In most neoplasms, the longer the duration of symptoms the greater the curability. The rapidity of a growth is proportional to its grade of malignancy and accelerated growth rate is suggestive of greater malignancy. Such a change may take place at any time, and when this occurs the growth rate overshadows in importance the duration of the disease.

The extent of the disease outweighs all other factors in determining the prognosis. Curability is lessened as the disease extends. Adherence to bone, cartilage or fascia, "frozen neck, breast or pelvis" and node involvement are bad prognostic signs.

Maltreatment by trauma and infection tend to lessen curability and the age and general condition of the patient may modify the prognosis.

Observations on Irradiation

An estimate of the effect of irradiation is based on a thorough study of the patient and the tumor, which reveals the many factors determining the applicability of irradiation and probable response.²

The location of the disease is important in determining accessibility and the therapeutic technic. The surroundings may be sensitive to irradiation damage. For example, the sensitivity of the normal tissues about a lesion in the hypopharynx does not allow the application of such intensive irradiation as may be applied in tumors of similar histologic structure elsewhere, as the cervix uteri. The proximity of vital structures may render treatment hazardous. Thus irradiation fails in esophageal cancer though the situation is ideal for application, because lethal dosage may cause perforation of the viscus. The difference in selectivity of the rays as between can-

cer cells and normal structures may be slight. The radiotherapist must always modify his method so as to take advantage of the estimated variation.

The extent of the disease compels modulation in treatment. Cancer of the cervix uteri is very deceptive as to depth of penetration because of the nature of the surrounding lymphatic drainage, and radical operation has been largely displaced by irradiation as the treatment of choice. Metastatic disease may respond more or less readily than the original tumor, depending upon its location and the nature of the original growth. Where the situation or extent render it inoperable, irradiation should be pushed to the limit of tolerance. Recent improvements in the technic have made deep-seated lesions more amenable to irradiation therapy, and the outlook is hopeful that in the future increasing dosage may be administered to deep areas without serious damage to surface structures.

The patient's condition is important as irradiation response is poor in aged, debilitated and cachectic individuals. Anemia impedes response. General infection may hinder reaction, but syphilis does not interfere if subjected to proper treatment.

By studying tumors undergoing irradiation we have learned many factors which control the reaction. Knowledge of the histologic factor is the most important information in estimating response to irradiation.³ Therefore, study of the biopsy specimen is of primary importance. What may seem clinically to be a responsive lesion may prove a resistant one.

Radiosensitivity of a tumor is a relative term applied to the degree of regressive response elicited by a given dose of irradiation of given quality. Response is determined by many factors, the tumor, its site and environment.⁴ The most important factor governing radiosensitivity is the fundamental nature of the tissue of origin of the tumor. Various normal tissues as well as tumors derived from them react differently to irradiation, each having an inherent "specific sensitiveness."⁵ This phenomenon is apparently related to the life cycle of the constituent cells. Cells having the shortest life cycle, for example, lymphoid cells, are most sensitive, and those having the longest life cycle, for example, nerve cells, most resistant. Embryonal cells having a short cycle are sensitive. The more adult, differentiated cells prove resistant in proportion to the tendency of differentiation. Tumors composed of a highly anaplastic growth are apt to be more sensitive than differentiated tumors of the same fundamental nature. Radiosensitivity must not be confused with grade of malignancy, however, as the fundamental nature of the tumor and other factors are of prime importance. Some highly anaplastic tumors, such as melanocarcinoma, may be most resistant.

Connective tissue growth within the tumor and the tumor bed decreases sensitivity, and desmoplasia may render a tumor resistant. Witness the inherent resistivity of fibrosarcoma and the poor response of metastatic nodes lying in dense fibrous tissue. Tumor cell necrosis following irradiation appears many times due to vascular changes within the tumor and surroundings. The regressive response to irradiation of papillomata probably occurs mainly as a result of such an effect. Free blood supply within the tumor and its bed seems essential to active response, while the ischemia following vasoligation prior to irradiation impedes response. Vasculo-connective tissue sclerosis produced by irradiation renders the tumor more resistant to subsequent treatment till the lesion becomes unresponsive and "radium fast."

Active infection within the tumor or its bed interferes with successful irradiation, and this factor may be more important than the fundamental nature of the tumor in estimating response. Treatment seems to aggravate the infection and the tumor may become more proliferous.

Bone is a poor bed for irradiation. Witness the unsatisfactory results of irradiation in attempts to control epidermoid cancer which has invaded the jaw from the floor of the mouth. Bone elements are easily injured and necrosis results. Cancer on a bed of cartilage responds poorly. The difficulty in treating epidermoid carcinoma about the ear by irradiation alone may be cited as an example. Fat breaks down, saponifies and forms a barrier to irradiation, giving a poor vascular response. The poor response of cancer situated in a fatty breast is well known.

The fact that a tumor is radiosensitive does not imply that it may be cured by treatment. Even the most sensitive lesions may carry a poor prognosis. Witness some tumors of embryonal origin and of the reticuloendothelial system. All sensitive lesions should not be treated by irradiation alone nor should every resistant tumor be deprived of the advantages of irradiation, even though serious injury to surrounding normal tissues may result. Such heroic measures are often necessary. Certain tumors respond to irradiation by "biologic sensibilization." The effect of irradiation of the ovaries upon uterine myomata is well known. Irradiation of the ovaries and of the pituitary gland is practiced for effect upon cancer of the breast and of the female genitalia. These phenomena further substantiate the probability of widespread influence of hormone activity upon neoplasms.

Observations on Surgery

The greatest improvement in recent years in the technic of oncologic surgery is the application of electrosurgical methods. Classic surgery has many advantages in certain instances and must often be used in combination with electrosurgical technic. However, the valuable advantages and more widespread applicability of electrosurgery in dealing with cancer are becoming more apparent.

The ideal to be accomplished in the treatment of cancer no matter by what method, is the removal of the growth in such a manner that recurrence will be decreased or eliminated. In dealing with localized lesions, experience in private practice and tumor clinic has yielded an impression of the superiority of electrosurgical methods over irradiation. Analysis of end-results bears out this opinion. The applicability of electrosurgical excision for biopsy in this regard has already been mentioned. When electrosurgery is used, normal vital tissues are preserved about the excised area. If the clinical extent of the lesion has been underestimated as shown by subsequent events, additional treatment may be rendered without the handicap of weakened tissue vitality, which invariably follows irradiation. Localized accessible cancer of the external envelope and body cavities is curable by electrosurgery. If, however, roentgen or radium therapy is selected as the primary treatment of a localized accessible lesion with clinical features of operability, it should be given up if regression does not occur promptly and completely. No risk should be run of allowing the disease to become inoperable.

Where clinical determination of the extent of a growth is in question, or doubt exists as to its operability, especially in high grade anaplastic lesions, preoperative irradiation may be used to limit the growth of possible outlying malignant cells. Those who have studied the question most thoroughly see no objection to delaying surgery in order to administer preoperative irradiation, as more favorable results may follow such a procedure. Such an opinion is substantiated especially in cancer of the breast,⁶ bone⁷ and body of the uterus.⁸ Postoperative irradiation should follow if any doubt exists as to whether extension is present beyond the resected area.

In more extensive lesions where excision cannot be made well beyond

the active process, surgery may be a valuable adjunct to irradiation. Often the removal of a large mass of the active lesion is helpful. On the skin, in the oral cavity, sinuses, breast, rectum, vulva and cervix uteri such a mass may be resistant or so extensive, infected or ulcerated as to form a barrier to successful irradiation. Partial removal by electrosurgery allows the application of more satisfactory radium or roentgen rays, oftentimes to the bed of the lesion.

Excision of accessible and apparently involved lymph nodes by electrosurgery or scalpel is often advisable, especially in disease of low grade malignancy. This provides a biopsy specimen which many times will reveal the presence of infection only and the absence of a neoplastic process. When nodes are obviously tumefied and large or necrotic, removal is many times of value for more successful irradiation.

At times when irradiation has been overdone there remains an indolent sclerosed or extensive ulcerated mass with attending pain. Many times viable cancer cells remain secluded. No other method approaches the efficiency of electrosurgical resection for relieving such conditions. Patients in this group express the highest gratitude for the relief obtained.

Summary

1. There should be full cooperation between surgery and radiotherapy, each being adjunctive to the other in cancer treatment.
2. Thorough clinical and histologic study is essential for accurate diagnosis, which indicates the prognosis and dictates the choice of treatment.
3. Determination of the applicability and response to irradiation depends upon many factors in the host and lesion. An estimate can be made only after a thorough clinical and histologic study.
4. Localized accessible lesions are best treated by complete electrosurgical removal.
5. Classic surgery, electrosurgery and irradiation are often indicated to greater advantage.

711 Medical Arts Building.

References

1. Ward G., and Geschickter, C.: Electrosurgical Biopsy, *Am. J. Roentgenol.* **35**: 248 (Feb.) 1936.
2. Kime, E. N., and Bowers, D. D.: Some Observations on Cancer Irradiation Reaction and Radiosensitivity, *Illinois M. J.* **74**:178 (Aug.) 1938.
3. Helwig, F. C.: Relative Importance of Histologic Analysis in Tumor Therapy, *Am. J. Roentgenol.* **37**:358 (March) 1937.
4. Stewart, F. W.: Radiosensitivity of Tumors, *Arch. Surg.* **27**:979 (Dec.) 1933.
5. Desjardins, A.: Radiosensitivity of Tissues and Tumors, *Arch. Surg.* **25**: 926 (Nov.) 1932; *Am. J. Roentgenol.* **32**:493, 1934.
- : Classification of Tumors from Standpoint of Radiosensitivity, *Am. J. Roentgenol.* **32**:493 (Oct.) 1934.
6. Pfahler, Geo. E., and Vastine, J. H.: Value of Preoperative and Postoperative Irradiation in Carcinoma of the Breast, Boggs Memorial Lecture, *J. A. M. A.* **110**:543 (Feb. 19) 1938.
7. Geschickter, C. F., and Copeland, M. M.: Tumors of Bone, New York, Amer. Journal of Cancer, 1937.
8. Crossen, H. S.: Clinical Classification of Cases of Carcinoma of Corpus Uteri, *Am. J. Obst. & Gynec.* **33**:587 (April) 1937.

Discussion

Dr. E. N. Kime (Indianapolis): The first essential in the management of any lesion suspected of being cancer is accurate diagnosis. The diagnosis may be ap-

proximated from clinical data alone in about two-thirds of all cases of cancer. On the other hand diagnostic efficiency is enhanced to about ninety per cent if

the surgical lesion can be correctly appraised by careful microscopic examination.

Everyone who purports to treat cancer by modern methods endeavors to classify his cases according to histologic type. Gradation of malignancy is considered of great importance, and rightly so. Low grade lesions should be managed differently than those with high grade anaplasia. Mixed cellular groups are not infrequent. These may vary not only as to type but also as to grade within one and the same tumor. It is therefore obvious that initial biopsy should be routine before irradiation. The exceptions to this rule, and every rule does have its exceptions, might be listed as follows:

1. Electrosurgical biopsy is curative in a high percentage of low grade localized readily accessible neoplasms. This is strictly speaking not an exception to the rule, since the procedure is primarily diagnostic in order to reveal the type, grade and probable extent of the growth. If the microscopic slides show that the lesion was low grade, and that it has been excised in mass, obviously no further active treatment is needed for that particular neoplasm.

2. When the neoplasm is clinically malignant and not readily accessible for biopsy, as in the breast, bone, and certain other situations, the best judgment of the surgeon may be that preoperative irradiation is indicated. In this case he must be prepared to evaluate the probable tissue variation due to the prior irradiation. Even so, biopsy is eventually to be obtained.

It has been stated that at least a decade is required for the correction of a well established clinical error. At the present time we are witnessing a wave of over-enthusiasm as to the efficiency of radiation in the cure of cancer. Daily articles

propagandizing radium are seen in the newspapers. Many laymen and not a few physicians are misled into the belief that cancer and radium or x-rays are scientifically correlated, one signifying a specific disease entity, and the other its specific cure. It is not generally recognized that radiation while very effective as an aid in the management of some tumors, is of comparatively little value in others. It should also be emphasized that prior to the use of radiation, a thorough examination should be made, seldom if ever omitting the microscopic evidence, if biopsy is at all possible. The essayist has given us the correct solution of the radiation problem in the requirement that every surgeon should think in terms of radiology as well as surgery; and conversely every radiologist should control his treatment by an accurate conception of the pathologic aspect of the growth. Co-operative teamwork between operator and radiologist is essential in all cases, irrespective of what method or combination of methods may be required. Since the determination of the applicability and probable radiation response to irradiation depends upon many factors in both patient and growth, an estimate of its scientific indication in each individual case can only be made after a thorough clinical and histologic study. Moreover, statistics as to cure of cancer are of little or no value, unless based upon actual and not postulated histologic findings. May we not conclude therefore with the admonition that the apparently widespread practice of treating supposed cancer by irradiation without biopsy be condemned as unscientific — in those cases in which biopsy can be readily obtained. This recommendation may be stated in its positive phase by urging that the management of neoplastic diseases should be controlled by a correct appraisal of the pathologic phase in each individual case.



ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

∴ EDITORIALS ∴

IMPRESSIONS OF THE NEW YORK CONVENTION

With interesting regularity this section has presented in broad strokes the "march of progress" in physical medicine as viewed from the vantage of each annual session of the American Congress of Physical Therapy. Each year the Congress epitomizes the trends of practice on our continent, and provides an authentic orientation of its progress throughout the world. The first World War brought to our attention the splendid effectiveness rendered by physical therapy to all the belligerent nations and emphasized the great value of conventional diathermy and the several important components of light. The succeeding years brought more light to light as a reliable and dependable therapeutic agent, and so stabilized the practice of high frequency therapy by the excellence of contributions as to have it universally acclaimed as an important branch of clinical medicine. In retrospect we see the cavalcade of physical measures taking temporary leadership, so that one recalls the great interest shown in ultraviolet radiation and its dramatic activation of the vitamin D component in the sterols of the skin. Medical and surgical diathermy also occupied an important position in the consciousness of the profession only to be challenged by iontophoresis of vasodilating drugs. To this is added pressure therapy in peripheral vascular disease and this by a re-awakened interest in the value of classic manual therapy, massage and the like. Climaxing all, short wave diathermy is now holding the keenest attention for its manifold applications in pathologic processes.

With this as a background we may now record the aims and accomplishments of the eighteenth annual convention of the American Congress of Physical Therapy which proved unusual in many respects. Although in some quarters it was feared that the attraction of the World's Fair and the geographic location would affect the attendance, all doubts were dispelled when Paul Liebesny, now of New York and formerly of Vienna, opened the scientific session with an important original study. The auditoria were filled to capacity throughout the four days, which were interrupted only by an afternoon's excursion to the Fair grounds to view some of the rare and extraordinary scientific exhibits and to listen to special addresses.

It is recalled that before the actual opening of the Congress, four days were given over to a seminar. There is no gainsaying that the best available authorities on various subjects presented the important fundamentals of physical therapy so lucidly and richly that all participants at the conclusion had nothing but words of praise and appreciation for the informative value of the short but intensive course. The particular value of the seminar rested therein that the various lectures were not the usual stereotyped presentations given in textbooks, but such expressing the views of the individual lecturers gained by actual experience and critical observation. At that the entire course had the character of full freedom of expression. As one lecturer put it, science is democratic, and each practitioner has the full freedom of a member of a liberal community in which autocracy has no place. Each forenoon was devoted to clinical demonstrations in various hospitals.

The program being available, there is no special need at this time for a detailed recapitulation. That most of the contributions had been as informative as valuable goes without saying. If we are to summarize the total gain from this annual session it would be in the statement that physical therapy has been placed not only on a broader basis but its practice has been rationalized in accordance with scientific principles that have not been fully evaluated in the past by the concerned clinicians. While it is admitted that there have been no dramatic or startling innovations, except possibly in a very few instances such as refrigeration therapy of cancer or the detection of focal infection by short wave diathermy, to which possibly should be added the certainty and facility of therapeutic dosage of the short wave current, the remainder of the papers should not be underestimated. There is all the more reason for this impression since individually and collectively the presentations have undoubtedly added to our sum total of knowledge concerning many and varied problems in the field of physical medicine. Accordingly the New York session has correlated many phases of previously dissociated problems with the result of greater unity and solidity of present day practice.

The scientific exhibits merit highest praise. As was alluded to in an earlier issue, there were displayed many original findings by extensive research. The array was so great and so informative that lack of space precludes their description in order to do justice to all the splendid features of this part of the convention. The commercial exhibits, too, left little to be desired in the way of innovations, many new apparatus, devices and instruments having been displayed with which few, if any, were familiar. The older firms that had regularly supported the Congress by exhibits in previous years also showed recently completed models of all sorts of apparatus utilized in physical therapy. Theirs was a dignified presentation of advances in equipment as such without evidence of the usual commercial exploitation.

The awards for excellence and originality in the scientific exhibits are published elsewhere in this section, as are the names and citation of two American, one French and one British scientists who were awarded the Gold Key of the Congress and an Honorary Life Membership. The men so honored occupy an enviable position as pioneers in their respective fields of physical therapy, all of whom have at least half a century of service to their credit. The bestowal of the highest honor of the Congress was therefore not merely a matter of acknowledging scientific merit but a sentimental expression which met with unanimous acclaim.

The banquet was an enjoyable affair and well attended. There were but few after-dinner addresses so that it was brought to an end at a reasonable hour. President Schmidt in his capacity as toastmaster introduced leaders of medicine with his usual tact and innate wit.

As in previous congresses, the Board of Governors and executive committees transacted considerable business, all to the best interests of organized physical therapy. The decision to hold the 1940 convention in Cleveland, Ohio, was a happy one, both from the standpoint of location and clinical facilities. The Congress cannot rest on its laurels, and its responsible officers are already at work with the aim of rendering the next annual convention at least as successful as the one that has just gone down in the history of American Physical Therapy.

DUCHENNE SOCIETY SENDS GREETINGS TO CONGRESS

[It is with particular pleasure that we herewith publish the greetings of the Duchenne Society of Great Britain brought to the Congress in person by their delegate, Dr. Phillipe Bauwens, and the acknowledgment sent to that distinguished body on behalf of the Congress by its President. — Ed.]

Greetings from the Duchenne Society for the Advancement of Electrotherapy of Great Britain to the American Congress of Physio-therapy.

At a meeting of the Duchenne Society held at the Treloar Hospital, Alton, Hampshire, England, on the 10th of June, 1939, it was unanimously decided to delegate Dr. P. Bauwens, the Honorary Secretary of the Society to convey to the American Congress of Physio-therapy, the most cordial greetings of the Duchenne Society and to express the most hearty good wishes of the Society for the success of the forthcoming meeting of the American Congress.

The members of the Duchenne Society hold in very high esteem and greatly appreciate the very valuable influence on the development of electrotherapy of the early American pioneers, Dr. Benham Snow, Dr. W. J. Morton, Dr. Grainger and others, and they appreciatively realize the success and efficiency with which the Members of the American Congress of Physio-therapy are continuing the researches of their distinguished predecessors.

It is, therefore, the unanimous wish of the Duchenne Society to convey to the American Congress of Physio-therapy their most hearty congratulations upon their past work and their sincere conviction that the future efforts of the Congress will continue to lead the way in the advancement of a subject which Electro-therapists in both countries have so much at heart.

It is in such a spirit of appreciation of the past work of the Congress and in the confident hope of its future influence that the Members of the Duchenne Society delegate Dr. Bauwens to convey personally to the Congress their Salutations and Good Wishes.

Signed on behalf of the Duchenne Society.

W. J. TURRELL,
President.

Reply by President Schmidt

The American Congress of Physical Therapy to the Duchenne Society for the Advancement of Electrotherapy of Great Britain

Greeting:

On behalf of the officers and members of the American Congress of Physical Therapy and by their authority expressed in a unanimous vote the Congress begs to acknowledge the cordial greetings and conveyance of fraternal good will through the Honorary Secretary of the Duchenne Society, Doctor Philippe Bauwens, which greetings were read during the banquet of the Congress at its eighteenth annual convention in New York City and received with great acclaim.

The Congress is fully aware of the scientific achievements of the individual members composing the Duchenne Society and deems it a great honor to be in receipt of such a cordial expression of recognition and of good will.

Cognizant of the present tense political situation particularly affecting the European continent, the Congress realizes the splendid geniality of the Duchenne Society in having it named for a French savant, representing as he does a great nation with whom Great Britain is now allied in true democracy and the preservation of human liberty and civilization, for which

the American people have a serious and sincere hope of success.

The Congress in returning its heartfelt best wishes to the Duchenne Society, singularly and collectively, express the hope that a long and fruitful existence may be in store for this your distinguished body.

The Congress hereby acknowledges with profound admiration the scientific achievements in electrotherapy by our colleagues in Great Britain, and recalls with profound respect the labors of the late Sir Lewis Jones, Dr. Elkin P. Cumberbatch and others of your great body, nor can the Congress fail to express its great admiration for the scientific labors of your honored President, J. Turrell, whose pioneering work in modern physical therapy has been a great inspiration for our efforts in the United States of America.

For the American Congress of Physical Therapy.
WILLIAM H. SCHMIDT,
President.

AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1939



For some years the American Congress of Physical Therapy has bestowed upon men who have rendered outstanding services to Physical Medicine its highest expression of recognition in the form of a gold key of merit. It has been the duty of a carefully selected Committee on Awards to select only such men throughout the world, who have made most valuable contributions to physical medicine and allied sciences, not only for the purpose of rendering honor to whom honor is due, but also to serve as a stimulus for others, especially younger workers to undertake original research in any of the manifold subjects furthered by the Congress.

For this the eighteenth annual session the Committee begs to announce that four scientists have been chosen after due and deliberate consideration for this signal honor; namely, two Americans, one Frenchman and one Englishman. Their names and citations are:

Rivière, Joseph A., distinguished son of France, originator of the application of the high frequency current for the destruction of malignant and other tumors, and rightfully entitled to the designation of father of electrosurgery. A specialist in physical therapy of many years he has contributed many books and articles on various subjects of his specialty. He is also entitled to the distinction of being a recognized humanitarian having been one of the first in Europe to organize the medical profession in a league for peace at a time when the European continent was again menaced by the tragedy of war.

Titus, Edward C., distinguished son of New York, one of the first and oldest pioneers in physical therapy who in season and out of season has not only advanced the cause of physical medicine but has proved the mentor and

educator of many physicians in this branch of medical science. His wide and extensive labors deserve all the more recognition when it is considered that he was in the vanguard at a time when physical medicine was in the initial stage of development and did not receive the attention and recognition this branch of the healing art merited.

Hirsh, A. Bern, distinguished son of New York, in recognition of outstanding services rendered the cause of physical therapy during his service with the United States Army in the World War and since then as one who has utilized physical measures for the rehabilitation of disabled soldiers in the Veterans Administration. Distinguished author, medical editor and one of the leading pioneers in the field of physical medicine.

Mennell, James B., distinguished son of Great Britain, pioneer orthopedic surgeon who has devoted many efforts in the employment of physical therapeutic measures in the relief of many conditions with particular reference to low backache and affections of the articulations. Author of several exceedingly valuable monographs on special phases of physical measures with particular regard to manipulative procedures.

AWARDS TO SCIENTIFIC EXHIBITORS

The Jury of Awards for Scientific Exhibits presented through its Chairman, Dr. Fred B. Moor, the following awards:

The Gold Medal to Dr. *Henry W. Meyerding*, of the Mayo Clinic, Rochester, Minnesota, for excellence in an exhibit showing the causes and treatment for low backache.

The Silver Medal to Dr. *M. Friedlander*, of the Mount Sinai Hospital, New York, for excellence in a study showing the temperature of calf muscles. The same award goes to Drs. *William Bierman* and *S. Silbert*, of the Mount Sinai Hospital, New York, who collaborated with Dr. Friedlander.

The Bronze Medal was awarded to Dr. *A. B. Hertzman*, of the Department of Physiology, St. Louis University School of Medicine, St. Louis, Missouri, for excellence in his exhibit on photoelectric plethysmography. The same award goes to Mr. *J. B. Dillon*, of the Department of Physiology, St. Louis School of Medicine, St. Louis, Missouri, who collaborated with Dr. Hertzman.

A certificate of Honorable Mention was presented to the following:

Drs. *Disraeli Kobak* and *Louis B. Newman*, of the Cook County Hospital, Chicago, for their contributions to cryotherapy.

Dr. *George Lyford*, of the University of Cincinnati, Cincinnati, Ohio, for his display on the diagnosis and treatment of pelvic infections.

Dr. *Samuel Sedwitz*, of the Youngstown Hospital Association, Vascular Clinic, Youngstown, Ohio, for his studies on peripheral vascular disease.

Dr. *K. G. Hansson*, of the Hospital for Ruptured and Crippled Children, New York, for his electromyographic studies.

The American Occupational Therapy Association for their interesting exhibit to inform the medical profession as to the value of this adjunct treatment.

Dr. *O. L. Huddleston*, of the University of Colorado; Drs. *E. J. Baldes*, *Julia Herrick*, and *Frank H. Krusen*, of the Mayo Clinic and Mayo Foundation, Rochester, Minnesota, for their exhibit showing the effect of artificial fever on the circulation.

Dr. *Anna Samuelson*, of the Mount Sinai, Lenox Hill, and Morrisania Hospitals; Dr. *Benjamin Jablons*, of the City, Polyclinic, and Welfare Hospitals; Dr. *George Singer*, of the Morrisania Hospital, and Dr. *Madge C. L. McGuinness*, of the Lenox Hill, and Misericordia Hospitals, New York, for their studies on peripheral vascular disease.

THE FIRST ANNUAL SESSION OF THE SOCIETY OF PHYSICAL THERAPY PHYSICIANS

A new society to be known as The Society of Physical Therapy Physicians has been formed with forty-two charter members for the purpose of developing physical therapy as a formally recognized specialty. This society which first met informally a year ago completed its organization during the eighteenth annual session of the Congress. As its name implies its membership will be restricted to such physicians who devote themselves exclusively to the practice of physical therapy in contradistinction to those of the American Congress of Physical Therapy which includes all ethical physicians and surgeons who are interested in physical therapy while engaged in general practice.

It was agreed by the charter members to hold their 1940 session separately but during the next annual session of the Congress at Cleveland, Ohio, and to devote one evening of the program of the Congress to special and technical subjects. The membership is limited to one hundred bona fide specialists who have devoted at least five years to this specialty and have or are holding teaching and directoral positions in physical therapy in America. Membership will be offered to qualified men by individual invitation.

For the current year the following officers will guide this new society:

F. H. Ewerhardt, M.D., President.

Wm. Bierman, M.D., President-Elect.

F. H. Krusen, M.D., Vice-President.

J. S. Coulter, M.D., Secretary and Treasurer.

The ARCHIVES OF PHYSICAL THERAPY will be the official organ of the Society with Disraeli Kobak as its Editor.

IMPORTANT NOTICE

THE CLASS OF JUNIOR REGISTRATION

will close permanently January 1, 1940. Examinations will be arranged according to individual needs. For further information, please write, Registrar, American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago.

SCIENCE, NEWS, COMMENTS

Officers for 1939

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Arctic Explorer Victor Levine Sends Greetings

Our intrepid arctic explorer, Victor E. Levine has sent greetings to his colleagues in the States from the farthestmost northern habitation, the village of Juneau. It was there that several years ago he witnessed the fatal accident of Will Rogers and ministered first aid to him and his companion in flight. Since then Dr. Levine has been on several extensive explorations to the North Pole and brought back invaluable data on the life and health and habitat of the Eskimos. This his most recent adventure is bringing him back laden with concrete information on the adaptive ability of the Eskimo toward certain encroachments of civilization and their reaction to such diseases as measles and the like. We are informed that this summer the Arctic region has suffered from a severe epidemic of measles during which period Dr. Levine was able to study the comparative actions of this disease on our northernmost aborigines. It is high time that our friend presented in written form his interesting and valuable experiences to the medical profession.

Cancer Diagnosis In Mice

If cancer diagnosis by changes in the body's electrical field, reported by Prof. H. S. Burr of Yale University as giving promising results on mice, proves to be applicable to human beings, a great step forward in science's fight with cancer may be taken.

Significant changes in the body's electric field occur with growth of the body cells and appear to occur at the start of the extraordinary growth of cells which produce cancer. If this is true in mice, it may also be true in men, although Prof. Burr in his paper before the Academy was careful to limit his report to experiments upon mice alone.—*Science News Letter*.

Reduce to Avoid Diabetes

Avoid eating many fat foods to avoid getting diabetes may be the advice doctors will give in the future as a result of research reported by Drs. Reginald E. Haist and Jessie Ridout and Prof. C. H. Best of the University of Toronto.

Doctors are already advising people to avoid overweight as a precaution against diabetes because overweight persons are known to be more likely to develop the ailment. The reducing diet for prevention of diabetes, if advised on the basis of the research reported, would cut down fat foods more than sweet and starchy foods.

Diets very rich in fats markedly reduced the insulin content of the pancreas in experimental animals, the Toronto investigators found. Lack of insulin, due to failure of the islands of Langerhans in the pancreas, causes diabetes. Diets very rich in carbohydrates, that is, in starchy and sweet foods, did not decrease the insulin content of the pancreas.—*Science News Letter*.

Copyright for Scientific Discoveries

Several European scientific bodies have recently discussed the injustice suffered by scientists who live and die in poverty because their discoveries have yielded them no material rewards. Some years ago the International Institute of Intellectual Cooperation, an offshoot of the League of Nations, fathered the suggestion that some form or other of copyright should be conferred on the authors of scientific discoveries; and no less a person than Monsieur Bergson insisted on behalf of this body that, in the field of scientific discovery, the author of a new idea was entitled to a copyright in it and not merely in some application of it. A commission, appointed by the French Academy of Medicine and composed of some of its most distinguished members, including Balthazard, Portier, Ramon, Feissinger and Vincent, has recently reported to the

Academy on its findings. The Academy responded to this report by unanimously passing a resolution in which it urged the Government to submit to Parliament, legislation designed to protect the rights, material and other, of savants and inventors in every domain in which their discoveries and scientific inventions are manifested. It is hoped that this resolution will help to spur the Government on to executive action; and this hope is the stronger for the fact that the Government has already undertaken to bring up to date legislation dealing with copyright as applied to the authors of literary and artistic works. There will, of course, always be scientific discoverers who end their days in poverty in spite of having given priceless riches to the community, but it should be possible to remove the most gross and obvious injustices in this sphere by appropriate legislation providing for the diversion back to the discoverer of some of the wealth he has conferred on his fellow-beings.

Ultraviolet an Aid in Finger Printing

Science's newest aid to law enforcement comes through the ingenuity of Dr. Francis F. Lucas, of the Bell Telephone Laboratories. Dr. Lucas had noticed that on many finger prints the fine powder commonly employed by the police technicians does not stick. He knew that a slight deposit of the body's natural oil holds the powder on a "good" finger print. The problem therefore was to find something to make even a slight trace of this oily material highly visible. Paper bearing suspected finger prints is first treated with Flemming's solution, and then dipped into a dye which, under ultraviolet light, glows with a brilliant blue-green hue. The finger print stands out black and stark against this shining background. Its finest details can be examined under a low-power microscope, or it can be photographed up to any enlargement desired. If the paper bears print or handwriting, filters over the camera lens can cut off the ink from registering on the film, leaving only the boldly showing finger prints.

Brandy "Shot" Brings Mental Patients Out of Stupor

Alcohol can bring men out of a stupor as well as drive them into one. Brandy can do the trick if given in real "shots" — by hypodermic injection.

Men lying in the death-like stupor of the mental disease schizophrenia have broken a silence of months as a result of getting mildly intoxicated on brandy, it is revealed by Drs. N. V. Kantorovich and S. K. Constantinovich, of the Medical Institute and Psychiatric Hospital, Leningrad, in making a preliminary report of their experiments to the American Psychiatric Association.

The brandy was given by hypodermic because patients in this condition could not be made to swallow the liquid. The results promise a new

method of treatment for these inaccessible sufferers walled in by a barrier of silence.

"M," a young musician only 21 years old, had been ill for a month. He could not answer a single question put to him by the physicians or hospital attendants. He just grimaced, shrieked, or muttered unintelligently.

A few minutes after receiving the brandy, this patient quieted down and answered the physician's questions readily. Later he was able to write a coherent letter to his mother. In a couple of weeks he appeared to be entirely recovered.

Another young man had not spoken a word for over six months and had been ill for two years. He lay rigid with a mask-like expression on his face.

A few minutes after he received the brandy, he smiled and asked for a cigarette. Five minutes later he began to talk, and told the physicians the whole story of what lay behind his illness. He said that he had lain silent for months because he was afraid that if he attracted any attention his enemies would kill him.

After his "jag" wore off, he returned to his mute condition, but he has been noticeably improved, even able to do some work in the shop.

The physicians tried this method on 15 patients. Four were markedly improved. In seven other cases, the improvement seemed to last only while they were under the influence of the alcohol, but was considered worthwhile since it gave physicians some contact with them and clues about their mental state. In four cases, the alcohol seemed to produce no considerable improvement.

New Infra-red "Eye" Pierces Through Haze and Smoke

The new super-penetrating eye of science that pierces palls of haze and smoke, which was demonstrated before the American Association for the Advancement of Science, by Dr. V. K. Zworykin of the Radio Corporation of America, will have its first use in the confines of a biological laboratory, searching out new facts about life processes.

Important military and navigational applications of this new eye of science are, however, causing excited comment among the scientists. The new device, which looks like a telescope from the outside, does its seeing by the infrared rays that the unaided eye cannot see.

The heart of the new infrared "eye" is a thin film of caesioted oxidized silver, deposited on a metal plate. This substance is specially sensitive to infrared light, from the lower limit of visibility, at about 8,000 Angstrom units, down to about 10,000 Angstrom units.

When the infrared image of some object, either giving off infrared rays itself or reflecting them from an infrared searchlight, is focused on this special film, it gives off a stream of electrons from all the lighted parts of the image. These shoot up a tube, passing through a series of electrically charged rings, which bends them as a

lens bends light. This part of the apparatus Dr. Zworykin calls an "electron lens."

The focused stream of electrons, now arranged in image form again though still invisible, strikes on a second screen, this one covered with a fluorescent substance, working on the same principle as the ordinary fluoroscopes used in hospital x-ray rooms. This turns the invisible electron image into a visible light image, very clear and distinct. The process is thus summed up in three steps: first, the infrared rays from the object itself; then, the translation into electrons; finally the second translation of electrons into an image in visible light.

The uses of the new infrared "eye," in both peace and war, are manifold, though the usefulness of the device is limited to conditions under which infrared rays will travel through the atmosphere. Infrared will easily penetrate haze and smoke, but fog stops it because the water-particles in fog are too big to let the rays pass. They might get through very thin fog, but the real fog menaces to air and sea navigation are still baffling, Dr. Zworykin and his aides said.

Wartime uses that suggest themselves are obvious. Warship funnels and airplane engines emit infrared rays, so even at night they can be detected. It would do them no good to screen themselves in chemical smoke, for infrared rays pass through that easily. All that gunner, torpedo-man or bombing pilot would need do would be to aim at that spot of infrared that betrayed hot exhaust gases. A different wartime use could be in signaling. Enemy watchers could not see an infrared flashlamp unless they had an infrared telescope and knew exactly where to point it.

More peaceful uses range from aviation and astronomy to zoology. A series of infrared beacons could be used as landing lights when haze obscures the ground, or the buildings or other landmarks of the airport could be floodlighted with infrared.

Astronomers can study changes on the sun's rim during an eclipse, through haze or smoke or thin clouds that hitherto have defeated them. The device may also be used on stars and nebulae, since these also radiate infrared.

A highly practical use that has been suggested is the detection of forest fires. Often during forest fire season in the west, the air is so thick with smoke and haze that the lookouts on their towers have a hard time telling where the fire really is. With an infrared telescope they could sweep their horizon and actually see the flames through the smoke.

A more strictly scientific use is the one in which the device will first find employment. Many microscopic details of plants and animals are invisible under ordinary light, but show up under infrared. Infrared microscopes will therefore be very useful. Furthermore, many of the smaller animals are either killed by visible light or so repelled by it that they persistently flee from the microscope's field. With the new device adapted to microscopic viewing, these light-shy creatures can be studied without their knowing it.

A combined electric eye and amplifier that promises to speed television was also demonstrated by Dr. Zworykin. This device not only converts light into electricity like conventional photoelectric cells but steps up the current millions of times, all within a single tube.

Immediate practical applications to electrical gadgets, to television and to facsimile transmission of messages and pictures are foreseen.

The new electron multiplier works equally well with direct current or alternating current of any frequency. It utilizes what electricians refer to as "secondary emission." A stream of electrical particles is generated by light hitting a metal plate and then this electricity releases other electrons from a series of plates in ever increasing volume, all within one tube.

In one demonstration a phonograph recording was converted into fluctuating light which was picked up by the new electron amplifier some distance away in order to operate a loud speaker directly without intervening tubes. — *Science News Letter*.

An Innovation In Cabinet Baths

Recently the attention of the medical profession has been directed to an innovation in cabinet bath treatment. Under the proprietary name of "Thermalex Cabinet," a New York manufacturer has devised a cabinet along efficient and modern lines. It incorporates the use of vapor, mineral and dry heat baths in an especially constructed cabinet, which permits the patient to assume a semi-reclining and relaxed position during treatment. The fact is that this provides a method of heating without bulbs, wires or cables, and hence introduces a new means for use of a compact, efficient and inexpensive cabinet both for office and hospital treatment.

Ten B Vitamins Now Reported and More May Be Discovered

Vitamin B has now been chemically sliced into 10 different vitamins or factors and the end is not yet in sight, Prof. C. A. Elvehjem, of the University of Wisconsin, discoverer of pellagra-curing nicotinic acid, the third B vitamin, told a chemical research conference at Gibson Island, Md.

"The boundaries of the B complex are still unknown," Prof. Elvehjem declared. The B complex is "the group of water-soluble vitamins found in yeast." Liver and whole grains are also richly supplied with this vitamin.

Oldest of the B vitamins is the chemical now known as thiamin, which prevents and cures the nerve disorder, beriberi. Next in line is riboflavin, recently discovered to be essential for human health but known much longer as one of the B vitamins through discoveries of the dire effects on laboratory animals of a lack of this substance.

Nicotinic acid, preventive and cure for pellagra, was the third B vitamin to be cut out of the group by chemical dissection.

The spectacled eye factor is the picturesque way Prof. Elvehjem described one of the newest mem-

bers of the B group. Rats lacking this vitamin develop the condition described as spectacled eyes.

Pantothenic acid, acclaimed recently as a vitamin essential for all living forms, is the same vitamin that prevents a skin disorder in chicks, Prof. Elvehjem said.

The anti-gray hair member of the B group is apparently a rat vitamin only. Another rat vitamin is B₆, also called Factor I, and fortunately is now identified chemically and available in synthetic form. The chemical identification is fortunate because it helps to clear up some of the confusion about these vitamins.

Factor W, for rats, and Factor U, for chicks, and another substance known at present as vitamin M, apparently complete the list of the 10 B vitamins so far known.

How many and which of them, outside of thiamin, riboflavin and nicotinic acid, are essential in the diet of humans has not been entirely settled. The difficulties of chemical separation of the B vitamins from each other suggests that people eating plenty of food sources such as whole grains, liver and other fresh meat, and yeast, cannot fail to get all of the B vitamins.

The members of the group already available as chemical substances, thiamin and nicotinic acid, for example, are valuable for patients too sick to eat and assimilate the vitamin-containing foods.—*Science News Letter*.

Electricity Exists Wherever There is Life

Electricity is the architect of the human body. Experiments by Drs. Burr and Harman of the medical department of Yale University, reported to the American Neurological Association, hold important implications in the understanding of health and disease in the human body, including perhaps even cancer. It is becoming increasingly clear that wherever there is life there is electricity. Apparently, a portion of the energy absorbed by a living thing from food and air and sun, is converted into electrical energy.

This energy is present in a relatively steady state just as in a battery there is a relatively steady voltage between the two poles of a battery. Some organs of the body, as for example, the heart and the brain, modify this direct current electricity to form an irregular alternating current which we recognize in the heart waves and in the brain waves. Studies of the direct current characteristic of the electricity found in living beings show that these are relatively stable but may be changed by fundamental biological activities such as menstruation, ovulation, cancer, growth, and wound healing.

However, it is well known that whenever electrical energy flows through a conductor, an electrical field can be found surrounding the conductor. Since electrical energy does flow through the living system, one should expect to find a field in that living sys-

tem, unless electricity in living things is different from electricity in physical things.

If such a field can be demonstrated experimentally, it is by no manner of means impossible that it plays a major role in determining the pattern of organization in the living system. It has been possible to demonstrate the field experimentally by rotating a salamander on a revolving turntable under certain conditions. If this is done, the salamander produces a sine wave alternating current output analogous in every way, except in frequency and magnitude of output, to that of the ordinary electric dynamo. This suggests that voltage gradients in the nervous system may be responsible for the presence in the nervous system of a field which determines the location of nerve cells and the direction of growth in nerve fibers.

Voltage gradients in the nervous system of the white rat have been determined in some forty animals and show that the brain is positive to the spinal cord and to the peripheral nerve. The voltage rises as anesthesia deepens, and lessens as anesthesia lightens. In no case is there any reversal of polarity. When the animal dies the voltage drops slowly to zero, usually within an hour. However, the voltage between the spinal cord and the nerve may persist for several hours.

Since these voltages in the nervous system are analogous to those found in the whole living animal, and since the whole animal possesses an electrical field, it is logical to infer that the nervous system also possesses a field and it may well be that this field determines the structural arrangement of the parts of the nervous system.—*Science News Letter*.

Lack of Vitamin C May Be a Cause of Food Allergy

Lack of the scurvy-preventing vitamin C from citrus and other fruits and fresh vegetables may be one cause of food allergy, Drs. J. Bronfenbrenner, D. M. Hetler, Frances Love and Jack M. Burnett of St. Louis announced.

People with food allergy are the "one man's meat is another man's poison" folks. Even tiny amounts of certain foods, most often eggs, milk or wheat, gives these patients severe attacks of asthma, hives, migraine headaches or other allergic ailments. Treatment with ascorbic acid, as vitamin C is now called, may enable these people to eat the foods to which they are sensitive.

Guinea pigs furnish the evidence for this theory. Pigs made sensitive to egg white could eat this food when they were given the vitamin. When the vitamin was removed from their diet, practically 100 per cent of the animals developed allergic symptoms when fed egg white. If enough vitamin was given to these animals over a period of weeks, they could eat the egg white, although hypodermic injections of it showed they were still sensitive to the substance.—*Science News Letter*.

THE STUDENT'S LIBRARY

EXERCISE IN THE BATH. THE TOGNA SYSTEM OF HOME GYMNASTICS TO PROMOTE HEALTH, PREVENT DISEASE AND PROLONG LIFE. By *T. R. Togna*, with Introduction by Sir *Leonard Hill*, M.B., F.R.S., LL.D. Cloth. Pp. 125 with 35 illustrations. Price, 5 s. net. London: Putnam & Co., Ltd., 1938.

This brochure is the outgrowth of a layman's interest and studies of the effect of graded underwater exercise performed in an average sized bath tub. As a result of the marked benefits accrued from this simple hydrotherapeutic method it received the early support of Sir W. Arbuthnot Lane, who recommended the Togna system of home gymnastics as an intelligent study of health exercise. Essentially these consist of a sequence of regulated underwater movements that tend to stimulate every muscle in the body so that they are kept in a constant state of healthy activity. The fact that they are or can be carried out in a conventional bath tub makes a minimum demand on the nerve and muscle energy, and provides an adjuvant therapy at lowest cost and greatest convenience to that large group of patients suffering from a delicate and feeble physique.

The simplicity of the method as well as its physiologic effectiveness render this volume an interesting and thought provoking contribution on the most modern of hydriatric procedures. Experiments carried out at the London School of Hygiene, the Physiologic Department of the University College of London, and the Red Cross Clinic established a scientific basis for the author's claims, proving once again that the oxygen requirement in water is not only one-third to one-half that of air, but also that exercise under a water environment places a lesser strain on the cardiovascular and muscular systems and enhances the voluntary activity of certain inflamed immobilized and paralyzed parts to attain reparative states difficult or impossible by air gymnastics or similar forms of treatment. The present volume comes recommended by a brief but sincere introduction by Sir Leonard Hill who was impressed by Mr. Togna's system of exercises demonstrated at the St. John Clinic in London. Sir Leonard points out that these procedures "are very suitable for city people who wish to keep at bay the disabilities which arise from sedentary occupations." This work, however, has a broader implication because it demonstrates the value of underwater treatment under medical supervision in rheumatic affections, heart involvement, circulatory and renal disturbances, obesity and constipation, affections of the skin and as a tonic for weakened muscles and flagging strength. The book is well illustrated with actual photographs of the patient in the tub undergoing the various exercises expatiated by the author. The text is presented in simple and clear language and holds out large promise of great usefulness in conditions in which conventional exercises

are interdicted because of obvious dangers or failures.

THE SCIENTIST IN ACTION: A SCIENTIFIC STUDY OF HIS METHODS. By *William H. George*, M.Sc., Ph.D., F.Inst.P., Honorary Lecturer in Physics, University of Sheffield, Sheffield, England. Cloth. Pp. 354 with 31 illustrations. Price, \$3.00. New York: Emerson Books, Inc., 1938.

This volume deals with perhaps the most important quantum of research — the personality of the research student or scientist in action. It is an astonishing fact that while research in the devious problems confronting the scientist has stimulated further discovery and invention, the personality of the individual behind this tremendous and romantic drama of modern investigation is often as little known as though he were veritably sealed within a prison of his own making. Acclaimed by British and American scientific clubs, this work attempts to lift the mystery from the cumulative personality of the scientist by examining and analyzing his *modus operandi* for the benefit of future novitiates. It deals with the scientist as a thinking individual who organizes information into certain patterns of action. That such an exposition has the potentiality for creating an atmosphere of sustained interest is illustrated by the fact that no less a distinguished man of letters than H. G. Wells confessed that this book made him forget certain important obligations because he lost himself in its reading. It is interesting to record that the author's objective in the examination of the scientist is a problem of human action. His methods and thinking are analyzed as a type of human experience wherein the factors of behavior and expression are more important than his apparatus or the uses to which it is put. The exposition is divided into four major topics. First, it deals with what is today considered as the scientific outlook on the qualities of experience, its attitude toward temporal and absolute truth in relation to the variability and uniformity of nature, and the limitations of all values on the basis of the should-ought mechanism in experience. The second part discusses the methods used to obtain scientific facts. Is this method restricted to those highly specialized or do all workers depend on personal observations more than those witnessed by others, or can they only be found in certain patterns which special training will discover, or are they available by the process of abstract reasoning or a compromise of all? This the author evaluates in a comprehensive and critical manner. He discusses at interesting length the manner of arrangement of scientific facts and how scientists classify laws and theories and the order and patterns by which they build their experimental structure. Finally one arrives at the conclusion science has no boundaries as such but speaks the universal language

of the democracy of the intellect. This is an informative and fascinating work worth the attention of every serious minded physician.

GROSS ANATOMY. A BRIEF SYSTEMATIC PRESENTATION OF THE MACROSCOPIC STRUCTURE OF THE HUMAN BODY. *A. Brazier Howell, M.D., Associate Professor of Anatomy, Johns Hopkins University School of Medicine.* Cloth. Pp. 403 with illustrations. Price, \$6.00. New York and London: D. Appleton-Century Co., Inc., 1939.

The author explains in his introduction that this volume is essentially an exposition of the procedure followed in the course in gross anatomy during the 320 hours of instruction in the Medical School of Johns Hopkins University. While the book contains some illustrations, the recommended plan is to supplement the text with any good atlas of anatomy. This obviates no doubt the bulkiness that is to be found in most anatomy textbooks. Since it is intended as such, it needs no further introduction to physicians and students. The contents consist of 14 chapters, divided into such classic subjects as the skeletal system; articulation and ligaments; the nervous system and its meninges; the special sense; the muscular, vascular, respiratory and digestive systems and the endocrine glands. The lucidity of exposition renders this work especially valuable to all students whose objective is to obtain a clear and lasting impression of the gross anatomy of the muscular system. While it is apparent that many different texts can be obtained for the purpose of refreshing one's memory on the origin, insertion, innervation and action of the different muscles, one has yet to see a more concise and practical exposition than the one contributed by Howell. Each muscle is listed in alphabetic order, in bold face type, followed by a complete description of the origin, insertion, innervation and action. These stylistic arrangements add to the study value of the book and render it an ideal choice for students of anatomy. Particular attention is called to the dictional style of the index, because close attention has been given to the use of Latin and English names. The author believes usefulness rather than uniformity should be the purpose in the teaching and study of anatomy.

CLINICAL GASTROENTEROLOGY. By *Horace Wendell Soper, M.D., F.A.C.P.* Cloth. Pp. 314 with 212 illustrations. Price, \$6.00. St. Louis: The C. V. Mosby Company, 1939.

That the problems of gastroenterology have been reviewed with brilliancy, acumen and conservatism by the ablest of clinicians and research workers is attested not only by the accumulated encyclopedic literature but by the many current opinions that challenge past authority. In this volume the author has attempted to survey the latest views on the diagnosis and treatment of gastroenterologic diseases for the benefit of the specialist, internist and the general practitioner. The difficulty encountered was the dearth of opinions and repetitious contributions through which maze of assertions Soper found greatest need of an objective attitude in order to evaluate the rich data on this important topic of practice. Accordingly he chose the direct method of tersely reviewing the outstanding opinions of those

whose original labors have had the greatest influence on the management of diseases of the digestive system. The methods of diagnosis and treatment are, however, based on his own clinical experiences and were selected from those that had proved most effective and successful in his own practice. The work encompasses 34 chapters including an extensive bibliography. The contents are arranged in orderly fashion and are initiated by a skeletalized review of present-day diagnostic methods. The succeeding chapters evaluate the latest and most practical methods for the treatment of maladies of the entire digestive system. This part of the exposition begins with the problems encountered in the oral cavity and closes with those seen at the anal orifice. Special chapters are also devoted to the diet in relation to obesity; the practical value and adaptation of raw, evaporated and pasteurized milk; the treatment of the allergic problem; the application of surgical diathermy for extirpation of growths and lesions in the ampula recti and pelvic colon, and the management of diarrhea and constipation. From what has been said it will be appreciated that this work is a timely contribution of interest to both the specialist and general practitioner.

CRYSTALLINE ENZYMES. THE CHEMISTRY OF PEPSIN, TRYPSIN, AND BACTERIOPHAGE. By *John H. Northrop*, Member of the Rockefeller Institute for Medical Research. Cloth. Pp. 176 with 48 charts and 35 tables. Price, \$3.00. New York: Columbia University Press, 1939.

Enzyme study has borne a fruitful harvest of knowledge since the pioneering work of the great nineteenth century physiologists and biochemists, Bernard, Schwann, Corvisart and Buchner. In the last fifty years progress in this field has centered chiefly around the mechanism and nature of enzyme reactions, and in the course of this work much time has been devoted and many painstaking studies made to isolate and prepare the pure enzymes. This research has been carried to its most successful conclusion in the past decade by a group of workers headed by the author, including scientists from the outstanding universities of this country. In this monograph, based on the Jesup Lectures given at Columbia University in the spring of 1938, the results of a series of investigations on the isolation and chemistry of bacteriophage and the proteolytic enzymes are presented. These experiments carried out in the author's laboratory deal with the general chemistry of enzymes and their isolation; the preparation and properties of crystalline pepsin; of pepsinogen; of chymo-trypsinogen and chymo-trypsin, and the like. In the space of seven chapters including an especially detailed discussion in the form of an appendix, Northrop has managed to evaluate the problem of digestion in a succinct, lucid and authoritative manner. Briefly the separate chapters review not only the general concepts of the chemistry of enzymes, but devote special consideration to an analysis of the nature and methods of isolating as well as indicating their physiologic action. To be sure, many monographs are extant on this subject, but few there are that have managed to present such a scholarly and well correlated exposition.

DIE KATARRH - INFEKTION ALS CHRONISCHE ALLGEMEINERKRANKUNG. EINE DYNAMISCHE REKATIONS- PATHOLOGIE DES RHEUMATISMUS UND ÄTIOLOGISCH ZUGEHÖRIGER ERKRANKUNGEN ALS AUSDRUCK EINER SPEZIFISCHEN VIRUSINFEKTION. (CATARRHAL INFECTION AS A SYSTEM DISEASE. A DYNAMIC REACTION OF RHEUMATISM AS AN EXPRESSION OF SPECIFIC VIRUS INFECTION.) Von Dr. med. K. v. Neegard, Professor an d. Universität Zürich. Paper. Pp. 285. Price: Rm. — 11.25. Dresden and Leipzig: Theodor Steinkopff, 1939.

In this comparatively large-sized monograph the author has made a systematic attempt to develop a theory based on the etiology of a number of functional and microbic affections. In the main the book deals with so-called colds and rheumatic conditions, ranging from the common type to more or less intense articular and other organic affections. The author rejects the older concepts based upon synthesis rather than analysis and hopes that the ideas developed by him on the basis of numerous observations will rationalize the present-day therapy of many related conditions. His concept is designated by him as dynamic reaction pathology, a concept explainable by clinical synopsis with the application of the newer immunologic and epidemiologic data. The text proper, which opens with an introduction dealing with systemic diseases following simple colds, takes up the nature of the various forms of grippe, the symptomatology of catarrhal toxicosis as a secondary allergic stage, special types of reaction, differential diagnosis, vegetative neuroses, metabolic disturbances, the relation of a number of organic diseases and finally a detailed exposition of his theory, any possible objections to it and the proper methods of treatment under that theory. The subject matter is divided into eight sections and these into many subsections and subheadings. It is evident from the merest enumeration of the principal subjects that the study involves a large field of interest to physical therapists, especially climato- and balneotherapy, though this form of treatment does not occupy a very prominent place in his clinical exposition and philosophy. Whether one agrees with the author in his conception of a virus infection for the affections under consideration or not, his opinions merit most earnest consideration, because he betrays in every page qualities of an earnest and scientifically trained individual who has utilized a vast amount of clinical material before he formulated his thesis. All clinicians will do well to peruse this monograph with critical interest because it introduces a keenly analytical discussion on a terrain of medicine that is still beclouded by centuries of empirical practice and *propter hoc* logic.

EPIDEMIC ENCEPHALITIS, ETIOLOGY, EPIDEMIOLOGY, TREATMENT. Third Report by the Matheson Commission, Willard C. Rappleye, Chairman. Cloth. Pp. 493. Price, \$3.00. New York: Columbia University Press, 1939.

The Matheson Commission was established through the generosity of Dr. William J. Matheson in 1927. The first report of this commission was published in 1929 and the second in 1932. This third report is prepared on much the same lines as the first two reports. It presents a concise evaluation of their investigations on causal factors in relation to various allied diseases, and provides a summary of the treatment on encephalitis and a chapter on epidemiology. It is emphasized that re-education is one of the most important forms of treatment of epidemic encephalitis. The value of the work is enhanced by the precise review of the outstanding work of Bond and Appel in this field. It is also noted that the great majority of authors state that the results of fever therapy were unsatisfactory. The bibliography is encyclopedic in scope, because it occupies nearly three hundred pages. This volume therefore provides the readers with much valuable information on the latest advances in the etiology, epidemiology and treatment of epidemic encephalitis.

OFFICE GYNECOLOGY. By J. P. Greenhill, B.S., M.D., F.A.C.S., Professor of Obstetrics and Gynecology, Loyola University Medical School; Professor of Gynecology, Cook County Graduate School of Medicine; Attending Gynecologist, Cook County Hospital, Chicago, etc. Cloth. Pp. 406 with 106 illustrations. Price, \$3.00. Chicago. The Year Book Publishers, Inc., 1939.

There can be no question that there is great need for a book on medical and minor operative gynecology, which provides information on the diagnosis and office treatment of a large variety of affections of the female organs. The older books of a like nature which many years ago were regarded as useful guides have become obsolete, because the past decades have seen great advances in gynecology. The author's experience as a teacher of practicing physicians has enabled him to present the various problems encountered in daily practice in a manner adequately to meet their needs. Most of the chapters are very brief but to the point. One may question whether general practitioners will use such an expensive diagnostic device as the colposcope, or resort to the Rubin test or perform pneumoperitoneum, all of which are clearly described, but it must be admitted that the occasional gynecologist should have at least a working knowledge of their indications and technics. For the rest the author takes up the usual methods of diagnosis, opens the theme proper with prophylactic measures (post-partum care), takes up the various infections, of which trichomonas vaginitis is particularly well presented, and discusses with clarity such problems as the management of backache, displacements, cervicitis, cancer, anesthesia (local), pruritus vulvae, endocrine disturbances, urologic affections, anorectal diseases and obesity. A small chapter on sterility and arti-

ficial insemination is presented rather conservatively. Diathermy, electrocoagulation, thermotherapy, including the use of the Newman apparatus are described rather briefly but the subjects themselves are brought down to date. The author also gives a number of laboratory tests that are not commonly known. Accordingly this is an excellent manual for the intended purpose and fills a long-felt want.

AUTOBIOGRAPHY WITH LETTERS. By *William Lyon Phelps*. Cloth. Pp. 982 with illustrations. Price \$3.75. New York, London, Toronto: Oxford University Press, 1939.

Students of Americana and lovers of literature have long waited for the formal issuance of Professor Phelps' autobiography in order to enjoy an esthetic feast of rare quality. The impatience which the intelligentsia had shown in the anticipation of the perusal of this work not only is an index of the high reputation enjoyed by this American contemporary and leader of letters, but justified on the basis of a rare combination of qualities that has long singled out the author as the intellectual and spiritual mentor of the outstanding writers of modern literature. To read this book is not only to visualize Americana in their environmental unfolding from the gas jet day to the glare of tungsten illumination, but to see through the medium of his pen and rich memories the transition of American literature from the horse and buggy period of Mark Twain in America, to that of Victorian England as viewed through the mystic and romantic eyes of Browning, Tennyson and their contemporaries.

The evolution of wit, humor and rhetoric color as expressed by the facile writings of the modern school has been presented on a gigantic canvas of close to one thousand pages, upon which is depicted in entertaining and informative recollection the vivid and rich experiences of this foremost representative of our American teaching profession. The volume teems with anecdotes, literary criticisms, trenchant observations, humor and enthusiasms that are as sincere as they are infectious. The reading material is divided into 111 chapters, but is presented in that

delightful lack of order and symmetry as to protect one from that deadly monotony associated with contributions which attempt to conform too rigidly to a style whose unity is a clock, calendar and a frozen record of experiences. Life to Professor Phelps has been both prodigiously entertaining and intensely interesting, and his autobiography reflects an intellectual quality that is at the same time full of vivid memories. He carries one back to the days when college life was as different from that of today as the kerosene lamp was from present day electric illumination. In sharp contrasting strokes the reader is led through an important transitional period of American life and letters—college days at Yale; the spiritual influence of Sankey and Moody, and Sumner on the youth of yesterday; his impressions of European culture and of the life-long friends he made, such as Conrad, Galsworthy, Walpole, Maeterlinck, Chesterton, Hardy and other titans of modern literature.

That Phelps exerted a tremendous influence on American letters is seen in his portraits of such widely diversified personalities as the late President Roosevelt, William Dean Howells, Gerhard Hauptmann, Henry James, James Barry, George Moore, the late Pope Pius, Gene Tunney, Edna Ferber and many others. His travels were the gathering of golden impressions which are liberally showered upon the reader to the latter's great edification and entertainment. He visited every important cultural center of the world and brought back the honey of this experience for the cultural education of his students and friends. One therefore finds in this autobiography a veritable panorama of the richest impressions and affirmations submitted in vivid exposition and description, not only as a testament of what an alert and keen student can see, hear and learn throughout a lifetime devoted to the pursuit of the finest ideals in teaching, preaching and writing, but as a record of present day intellectualism in American life for emulation by the present and future generations in all civilized countries. A work of this kind emanating from such an unusual personality is a rarity in modern literature, which for the reasons already stated will remain an American classic for many years to come.



INTERNATIONAL ABSTRACTS

Vascular Obliteration for Various Types of Keratitis. Trygve Gundersen.

Arch. Ophthalm. 21:76 (Jan.) 1939.

The combination of diathermic cutting and coagulating current produced less trauma and probably had a more encouraging effect on regeneration of the vessels than other cutting instruments. Individual vessels or groups of vessels were severed where they crossed the limbus by a few cutting strokes with a sharp-pointed needle, the point of which was carried as deeply into the stroma as was necessary. In several instances the conjunctiva was dissected from the limbus and the underlying sclera in order to make possible the coagulation of the reticular supply. This procedure was of value when the corneal vessels were at the level of Descemet's membrane. When vessels are at this level, direct attack at the limbus might be hazardous and attended by perforation of the anterior chamber, although this accident has never occurred in my experience. More postoperative reaction occurs in the eye when the reticular supply is disturbed after conjunctival dissection than when a purely local attack is made at the limbus with the diathermy needle. Transitory hypotony was observed in a few cases, corroborating Jameson's observations; transient wrinkling of the posterior corneal surface was observed in others.

Industrial Dermatitis and Melanosis Due to Photosensitization. Harry R. Foerster and Louis Schwartz.

Arch. Dermat. & Syphil. 39:55 (Jan.) 1939.

For several years a manufacturer of electric conduits had observed a persistent and troublesome dermatologic condition among his workers. The physicians previously consulted had been unsuccessful in solving the problem of its origin and in relieving the workers affected, and the management then requested an investigation by the United States Public Health Service. Schwartz, suspecting photosensitization dermatitis, asked the co-author, who had not been on the case previously, to participate in the investigation. After this an inspection was made of a similar manufacturing plant in another state and of related industrial plants elsewhere, and research as to the etiologic factors concerned was undertaken. The authors then observed that dermatitis and melanosis are not uncommon in industries where tar and pitch are handled, that the preparations are important occupational hazards and that this is not generally known in this country. A review of the literature indicated also that the mechanism of production of these dermatoses had not been determined.

The Alteration of Blood Supply as a Cause for Normal Calcification of Bone. Harry C. Blair.

Surg. Gynec. & Obstet. 67:422 (Oct.) 1938.

Heat should be used only when it is the purpose to absorb calcium, as, for example, in calcification of the subdeltoid bursa or other heterogeneous calcifications. According to Blair the use of heat in acute bone atrophy is a vicious practice, because it increases the pain and absorption bone. Massage has been praised from time immemorial for increasing the circulation and certainly after massage the skin is warm and the part to which this treatment has been applied gives every indication of an increased blood flow. It would seem that massage is not indicated before complete union has taken place and all bone atrophy has disappeared. The active use of a limb by alternating the blood supply will help heal the fracture and recalcify the bone. In fractures about the ankle, if accurate reduction is obtained and complete fixation is possible, walking should be permitted since it allows contraction of the muscles of the leg and foot, though the ankle joint does not move. A non-padded walking case as described by Boehler allows walking without displacement of the fracture.

Contrast baths have been used for years to hasten healing of fractures and to mobilize stiff joints and decrease pain in injured extremities — this usually with the idea that it increases circulation. It is possible this procedure causes an alternation of the blood supply to the part. Theoretically it would seem that the use of alternating suction and pressure by increasing and diminishing the blood supply, might aid in the production of union.

Fracture of the carpal scaphoid belongs in some respects to the same category. Fixation is poor by any method. The slightest movement of the hand causes disturbance of alignment with a resultant reactive hyperemia, producing, if continued, cystic degeneration and non-union. However, if fixation in a dorsal splint is maintained and use of the hand continued, healing will occur in almost every case even after a long period since the original injury has elapsed.

Plasma Fibrinogen Response in Man. F. H. Ham and Fannie C. Curtis.

Medicine 17:381 (Dec.) 1938.

Ham and Curtis investigated the effect of nutritional deficiency and of protein feeding on the fibrinogen level in man and compared the fibrinogen response to artificial fever. The plasma fibrinogen response is compared to the variation in serum proteins, leukocytes and body temperature.

Their conclusions are that: 1. The plasma fibrinogen concentration in normal human subjects is relatively constant for any one individual and is not significantly influenced by the conditions of fasting, ingestion of food, rest and short violent exercise. The limits of concentration observed for normal adult men and women are from 190 to 330 mg. per hundred cubic centimeters of plasma, with an average level of approximately 250 mg. 2. In uncomplicated and untreated cases of pernicious anemia in which dietary protein has been inadequate, the fibrinogen concentrations vary from below normal to normal levels with a lower average concentration than that of healthy subjects. 3. Nutritional deficiency in pernicious anemia, in scurvy and in pellagra does not prevent an increase of fibrinogen above normal in the presence of infection. 4. In normal subjects the daily ingestion of animal protein produces a moderate fibrinogen response, usually within normal limits. 5. Remission from pernicious anemia does not result in an increase of plasma fibrinogen when the diet is deficient in protein but is accompanied by an increase of fibrinogen to normal when the diet contains 50 Gm. of protein daily. 6. Fever induced by high environmental temperature causes either no elevation or only slight and irregular elevation of plasma fibrinogen, while the intravenous injection of typhoid vaccine causes both fever and a significant and prolonged elevation of the fibrogen level. Therefore fever probably is not the only cause of the abnormally increased concentrations of fibrinogen observed in many febrile diseases. 7. In infectious disease the fibrinogen response may be independent of the temperature and the leukocyte changes and may occur despite a failure of the leukocyte response. 8. A failure of fibrinogen to increase above normal in instances of severe infection may be a poor prognostic sign and may suggest the presence of significant hepatic damage even though clinical signs of disease of the liver are lacking. — [Abst. J. A. M. A. 112:883 (Mar. 4) 1939.]

Blood Supply of Various Skin Areas as Estimated by Photoelectric Plethysmograph. Alrick B. Hertzman.

Am. J. Physiol. 124:328 (Nov.) 1938.

Advantage may be taken of the fact that the absorption of light by a transilluminated tissue varies with its blood content, to detect vascular changes with the photoelectric cell. The application of this principle of photoelectric plethysmography to the study of the skin circulation is described. The sources of error involved in the quantitation of the skin plethysmogram are discussed. They bear on the problem of the blood equivalent and on the qualitative accuracy of the plethysmogram. They are:

- a. Movement of the skin with respect to the plethysmograph.
- b. Influence of large artery in the immediate neighborhood of area observed.
- c. Character of contact of the plethysmograph with the skin.

d. Size and depth of the vascular area involved in the plethysmogram.

e. Variations in the intensity and spectrum of the illumination.

f. Influence of reduced hemoglobin—oxygenated hemoglobin ratios on skin opacity.

The essential validity of the photoelectric plethysmogram is demonstrated in simultaneous plethysmograms, photoelectrically and mechanically recorded, of the fingers, in instances where the vascular responses to some common procedures were followed. The argument is advanced and supported by suitable data that under resting conditions, with normal circulatory dynamics, the volume pulse of the skin area is a measure of the richness of the arterial blood supply of that area. The skin areas thus studied arrange themselves in descending order of the richness of their arterial supply as follows: finger pad, ear lobe, toe pad, palm of hand, skin of forehead and face, dorsum of finger, of hand and of foot, forearm, knee and tibia. Other areas could not be estimated. The effect of climate on the arterial blood supply of these areas is also indicated.

The Effects of Ultraviolet Radiation of Tubercle Bacilli. Kenneth C. Smithburn, and George I. Lavin.

Am. Rev. Tuberc. 39:782 (June) 1939.

Spiegel-Adolf and Seibert observed that various tuberculin preparations had absorption maxima at 2,650 Å. A lamp was commercially available which had a maximum energy output in this approximate region. It was therefore decided to use this lamp to study the effect of its radiation on the immunizing potency of tubercle bacilli. Simultaneously, studies were made of the effects of the radiation on the viability and virulence of mycobacteria.

The source of radiation employed was a mercury vapor resonance lamp. Approximately 90 per cent of the energy was emitted as radiation of 2,537 Å. Suspensions of tubercle bacilli contained in quartz flasks were exposed to the lamp while being agitated in a mechanical shaker so arranged that the flask was at a constant distance (15 cm.) from the source of radiation. During exposure the quartz flask was sealed with a close fitting gum-rubber cap.

The significant points brought out by this investigation are: first, that ultraviolet radiation may be so applied to tubercle bacilli that they are rendered non-virulent without being made non-viable; and second, that irradiated viable tubercle bacilli may induce demonstrable immunity in experimental animals.

The reduction in virulence is probably an effect on the individual bacterial cell which precedes the lethal effect occurring with prolonged exposure to radiation. The only other apparent explanation of the effect would be to assume that the reduction in virulence is due to early death, during irradiation, of a large proportion of the bacterial population; but that the survivors are

virulent. The results show that early death of a portion of the bacteria does occur; but the methods used to study virulence are so sensitive, and the dose of organisms used to test the virulence of irradiated suspensions was so large, that death would certainly have occurred had virulent organisms been present in the inocula. However, suspensions which failed to cause death when inoculated intracerebrally still contained organisms which grew in culture.

This latter point may have a bearing on the view held by some workers that bacteriologic methods are superior to animal inoculations for detecting tubercle bacilli. It is possible that their opinions are based on obtaining in culture attenuated organisms which are incapable of inducing disease in animals.

Regarding immunization with viable irradiated organisms, this procedure is not recommended for practical purposes as it would undoubtedly be associated with unwarranted hazards. In the experiments, organisms killed by irradiation did not induce demonstrable immunity. However, the authors used in these experiments dense suspensions which required long exposure to the lamp (ten minutes) to render the organisms non-viable. The heavy suspensions were used because it was desired to have a given quantity of organisms in the irradiated suspensions to be used as vaccine. This result could be accomplished by other methods, and the possibility remains that a weak suspension might be used in which very short exposure to radiation would cause death of the bacteria, conceivably without denaturing or rendering ineffective the immunizing antigen.

Prevention and Treatment of Bed-Sores. V. Zachary Cope.

Brit. M. J. 4083:737 (April 8) 1939.

A bed-sore is an ulcer or area of impaired nutrition of the skin and subcutaneous tissues due mainly to the too great or prolonged pressure on those parts of the body that are most subject to pressure when the patient lies in bed. In no department of medicine is the proverb "prevention is better than cure" more applicable than in bed-sores. In the great majority of cases it is possible to prevent them; and with well-trained nurses it is usually considered a reflection on their nursing capacity if a sore develops. The nurse prevents bed-sores by avoiding undue pressure on any one part; by preventing the inflection of minute traumata; and by improving the circulation and increasing the resilience and elasticity of the skin. It is the physician's part to improve the general condition and vitality of the patient, and to give advice when sores threaten or form.

If the elastoplast treatment is adopted it is essential to see that the whole of the ulcer and a considerable area of healthy skin around it are completely covered up; and the plaster must not be removed to see how the ulcer is progressing.

There are still many who prefer to treat bed-sores by the older methods of astringent or anti-

septic applications. There are many to choose from. Dakin's solution helps to separate the sloughs and clean up the surface of the ulcer. Hypertonic saline solution (5 to 10 per cent) has been recommended.

In addition to local applications, healing may be hastened by the use of artificial sunlight or ultraviolet rays to the part. When there is a large slough it may be advisable to cut it away. That is about as much surgical intervention as is ever required.

Physiotherapy in Furunculosis. Jean Meyer.

Brit. J. Phys. Med. 2:72 (Mar.) 1939.

Ten years ago Meyer considered ultraviolet irradiation as the best means of treating furuncles. Today short waves and x-rays have proved to be much superior. Ultraviolet, however, maintains certain local and general indications.

There are three indications for local applications. (1) Cicatrization of carbuncle lesion after the carbuncle has been checked by other methods. A treatment is given every second day, employing a moderate sub-erythematous dosage. (2) Resolution of the resisting cores of sclerosing furuncles by means of a single, very strong and strictly localized dose. The author employs a polymetallic arc lamp with a filter, giving the maximum heat which the patient can tolerate. When a sensation of burning occurs the lamp should be lifted for a few moments and then replaced in position. Duration of treatment is about 10 minutes. This technic was described in detail in 1926 by Meyer under the name of actinocautery. He then employed it for all furuncles, but has now discontinued it except in resistant forms. (3) Regional recurring furuncles. These affect a limited territory, for example the nape of the neck, the thighs, and the lumbar regions, and they last for weeks in spite of dressing. Nothing is better in these cases than a few ultra-irradiations. The erythematous dose must be given without causing blistering over an extensive area, which considerably overlaps the affected region. For this the polymetallic arc lamp is recommended. Practically every case responds in eight or ten treatments, given on alternate days.

Excessive Physical Exertion and Its Effect on the Kidneys. George Sanford Foster.

J. A. M. A. 112:891 (March 11) 1939.

It is interesting to note the changes in the individual urine voided just previous to as compared with the same individual specimens voided immediately at the completion of excessive physical exertion. All showed color concentration previous to exertion, five were slightly white, at the finish the same individuals showed a definitely cloudy urine. Ten of the specimens showed at the finish of the race from 2 to 12 points increase in specific gravity with an average individual increase of 6 points. All but one specimen showed an alkaline reaction before the race. Eleven men whose urine was normal previous to the race showed the presence of albumin following the race. Ten

specimens were positive to Benedict's solution previous to the race. In eight of these cases the specimens were still positive at the finish with a slight decrease in amount in one. Twelve specimens showed white blood cells in varying degrees previous to the run (no check on previous urethritis). Eleven of these showed white blood cells in varying amounts following the race. One runner showing the presence of white blood cells in sediment previous to the run gave no evidence in urinary sediment after the run. Two specimens showed red blood cells present in the sediment previous to the run. In one of these red blood cells persisted after the run and one showed none in the sediment after the run. Sixteen did not show red blood cells in the sediment previous to the run. Following the race none of these showed the presence of red blood cells in the sediment in varying amounts while seven showed no red blood cells in the sediment. Eleven had no evidence of casts in the sediment previous to the run. Following the race nine of these same runners had casts in varying numbers (hyaline and fine granular, short, narrow variety) while two did not show casts in the sediment. Seven had casts in the sediment previous to the run in varying numbers (hyaline and fine granular, short, narrow type). Following the race four of these still showed casts of the same relative types and numbers, while in the other three instances no casts were found in the sediment. Fifteen showed calcium oxalate crystals present in varying amounts in the sediment previous to the run. Three gave no evidence of these present in the sediment previous to the run. This undoubtedly indicates the influence of anxiety and apprehension in producing these crystals. After the race, of the fifteen showing the presence of these crystals previous to the run, nine still persisted in varying amounts, while six gave no evidence of these crystals in the sediment.

Industrial Dermatitis Due to Photosensitization. H. R. Foerster, and L. Schwartz.

Arch. Dermat. 39:55 (Jan.) 1939

Foerster and Schwartz observed that dermatitis and melanosis are common in industries in which tar and pitch are handled and that the preparations are important occupational hazards. These facts are not generally known in this country. More than 500 men were examined in four factories making electric conduits, more than half of whom had either melanosis or cutaneous lesions, chiefly dermatitis. The condition was confined to handlers of pitch or of pitch products, but those most intimately in contact with pitch were affected the least, while those who had the most severe dermatitis and the most intense pigmentation were outdoor workers. The pigmentation was diffuse and intense, considerably darker than ordinary sun tan, and it was confined to the surfaces exposed to sunlight. Pitch comedos and folliculitis on the face, neck, hands and forearms were commonly observed, and keratoses and papillomas were found occasionally. While some

men were affected more severely than others, apparently none sufficiently exposed were immune. Tolerance with persistent pigmentation developed in some men, but most of them had to be rotated between various jobs and some were so hypersensitive that they could not be employed in the daytime but worked satisfactorily on night shifts. The pigmentation was not permanent but it persisted at least for several months after the workmen were no longer exposed. On the basis of their investigation the authors conclude that pitch dermatitis and melanosis are the products of true photosensitization resulting from exposure to specific spectral bands of light. These conditions do not appear to result from chemical contact sensitization of the type of dermatitis venenata or from allergic predisposition and commonly occur in previously normal skin of normal subjects. The photosensitization occurs through local exogenous activity of a specific photosensitizer. The authors believe that these photosensitizing radiations predominate in the short wavelengths of the sun's spectrum, chiefly between 3,900 and 5,000 angstroms. Reactions may be obtained in the midultraviolet portion of the spectrum, apparently only after prolonged exposure of rays of wavelengths longer than 2,500 angstroms. Their investigations failed to establish definitely one specific ingredient of pitch or coal tar as the photosensitizing agent in pitch melanosis and dermatitis. However, they believe that the dermatitis and melanosis probably result from photosensitization by different ingredients of coal tar, possessing different fluorescent spectrums from these involved in the production of epithelioma and epitheliomatous conditions. — [Abstr. J. A. M. A. 112:1194 (March 25) 1939.]

Planning for State Hospitals. L. R. Bowen.

Modern Hospital 52:61 (Feb.) 1939.

On the second floor of the clinic for mental diseases a physiotherapy department has been established and a dental department and beauty and barber shops installed. On this floor also is provided a number of occupational therapy units of varying sizes for men and women each connecting directly into a large hall or gymnasium. These are intended for educational, recreational or work programs devised by the psychiatrist.

The third floor of the clinic section, which adjoins the wards where it is planned to house disturbed patients, is devoted entirely to hydrotherapy. On both the men's wing and on the women's wing sedative hydriatic suites, consisting of colonic irrigation, continuous bath tubs and pack rooms, have been installed. At the center of the section there is a tonic bath room to be used on alternate days by men and women; this is connected with separate rest and recreation rooms. This room has been equipped with various douches, sprays with necessary control equipment, saline, sitz, arm and leg baths and an electric light bath.